InfoRanger Service Manual

SCM-120R/SCM-120U

About This Guide

This guide is a service manual for the InfoRanger SCM-120R and SCM-120U. The size, the shape and color of the SCM-120R and SCM-120U are same and both of them have one Ethernet port. Different from SCM-120R, SCM-120U has one USB port besides Ethernet port. This guide explains first the common features of SCM-120R and SCM-120U and then the specific features of each with marking 'Only for SCM-120R' or 'Only for SCM-120U '.

This guide consists of following :

Chapter 1 Introduction to InfoRanger describes the features and specification of InfoRanger and shows RF signal information.

Chapter 2 Prior to Installation explains how to configure PC before installing the InfoRanger and the necessary items to install InfoRanger.

Chapter 3 Installing and Provisioning InfoRanger explains how to install the InfoRanger and connect cables.

Chapter 4 Using InfoRanger describes the function of each connector and the way of using LED.

Chapter 5 Using Diagnostic Program explains how to use diagnostic program to diagnose the memory, Ethernet, Cookie parameters, Upstream and Downstream status of InfoRanger.

Chapter 6 Using Management Commands explains the management commands used to test and debug the InfoRanger.

Chapter 7 Structure of InfoRanger explains the cable interface, microprocessor, memory, Ethernet interface and other miscellaneous part which constitutes the InfoRanger.

Chapter 8 Network Component describes the network component to support the DOCSIS-compatible Cable modem.

Chapter 9 Network Layer Properties describes the cable layer such as Protocol Stack, Ethernet Driver, Cable driver, Bridging.

Chapter 10 Web-based Management System explains how to check the current status of InfoRanger and change the configuration through the website.

Appendix A Troubleshooting shows how to solve the InfoRanger problems occurred in the field or service line.

Appendix B Testing InfoRanger explains breifly how to test the InfoRanger in the field.

Appendix C Part List lists the numbers and description of each part which constitutes the InfoRanger.

Appendix D Servicing Diagram shows the overall diagrams and exploded view of InfoRanger.

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Chapter 1
Introduction to InfoRanger

Chapter 1 Introduction to InfoRanger

The SAMSUNG InfoRanger is an external cable modem, which enables fast data communications using a cable network.

With the SAMSUNG InfoRanger, you can receive data up to 40Mbps, and send data up to 10Mbps. Compared with conventional telephone lines, this remarkable speed is 100 times faster than 56Kbps modem.

SAMSUNG InfoRanger is specially designed for the users who want to transmit data at high speed with lower cost. With SAMSUNG InfoRanger, you can enjoy the fastest communication speed.

NOTE

InfoRanger speed can be changed by the following factors.

- User's computer specifications
- Number of programs that is running on the user's computer
- Network traffic when user is connected
- Maximum Bandwidth provided by your service provider to the users

Features of InfoRanger

High speed

The InfoRanger lets you connect to the Internet, transmit e-mails, and download data up to 100 times faster than a 56Kbps modem.

Two-way data communication

The InfoRanger provides two-way data transmission. With the InfoRanger, you can download data up to 40Mbps, and simultaneously upload data up to 10Mbps.

Excellent compatibility : DOCSIS-compliant InfoRanger

In compliance with DOCSIS (Data Over Cable Service Interface Specification), the InfoRanger can receive services from any cable operators and can be used with other DOCSIS compliant CMTS (Cable Modem Termination System).

Quick and easy installation process

With the InfoRanger, the IP address is set automatically. The only thing you need to do is to setup according to installation guide.

Compact and convenient design

The InfoRanger is designed for easy to use and it fits well in any home and office environment.

Support USB port (Only for InfoRanger SCM-120U)

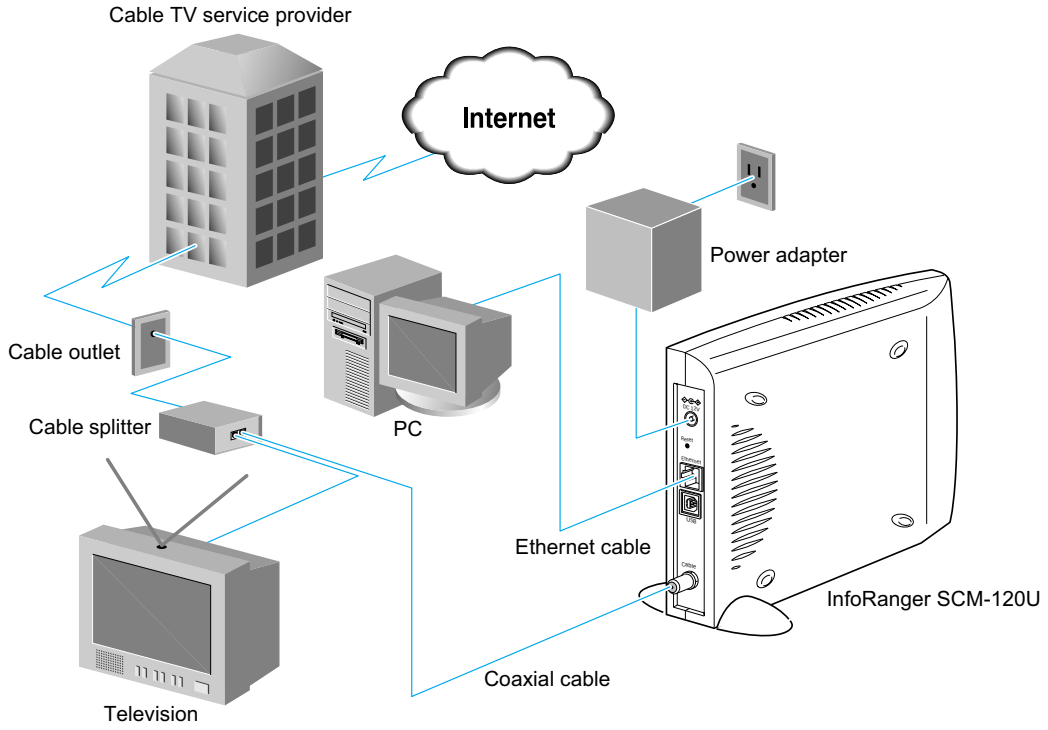
The InfoRanger SCM-120U supports USB port so that you can save trouble to open the case of PC and install network interface card. It is a fast, bi-directional isochronal, low-cost, dynamically attachable serial interface that is consistent with the requirements of the PC platform. It supports up to 127 physical devices, and its transfer rate assures up to 12Mb/s.

Examples of Network Connection

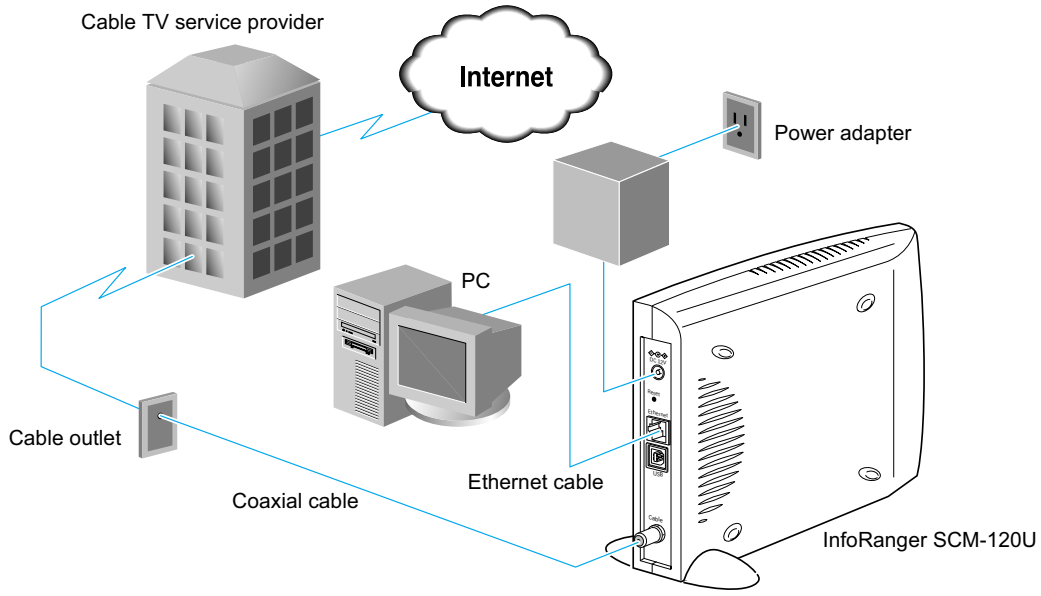
NOTE This diagram shows an example of using the Ethernet port of InfoRanger SCM-120U. The network configuration using InfoRanger SCM-120R is identical to it. In case of InfoRanger SCM-120U, you can even configure the network using the USB port instead of Ethernet port.

NOTE The specification and the shape of the power adapter contained in the package is different according to the regions where the InfoRanger is purchased.

If you subscribe to both CATV and the Internet Services



If you only subscribe to a Cable Internet Service



Product Specifications

Item		Specification
Interface	Ethernet	10/100Mbps, RJ-45 1 port (1.8m (6ft.))
	USB (for SCM-120U)	12Mbps, 1 USB port (1.8m (6ft.))
Temperature	Operating	0 to 40℃(32°F to 104°F)
	Storage	-25 to 70℃(-13°F to 158°F)
Frequency	Downstream	90 to 858MHz
	Upstream	5 to 42MHz
Modulation	Downstream	256QAM : 64QAM
	Upstream	16QAM : QPSK
Data rate	Downstream	64QAM (30Mbps), 256 QAM (40Mbps)
	Upstream	QPSK (5Mbps), 16QAM (10Mbps)
Channel spacing / bandwidth	Downstream	6MHz
	Upstream	200KHz, 400KHz, 800KHz, 1.6MHz, 3.2MHz
FEC	Downstream	RS (128,122) / Trellis
	Upstream	RS (Programmable)
Symbol rate	Downstream	64QAM : 5.056941Msps 256QAM : 5.360537Msps
	Upstream	160K, 320K, 640K, 1280K, 2560Ksps
Bits per symbol	Downstream	64QAM : 6-bits 256QAM : 8-bits
	Upstream	QPSK : 2-bits 16QAM : 4-bits
Level range	Downstream	-15 to +15dBmV
	Upstream	QPSK : +8 to +58dBmV 16QAM : +8 to +55dBmV
Carrier to noise ratio		64QAM : >23.5dB @ BER < 10^{-8} 256QAM : >30dB @ BER < 10^{-8}
Security		DES decryption / encryption
Physical dimension	Size	38(W)x178(D)x153(H) mm (1.52 (W) x 7.12 (D) x 6.12 (H) (˝))
	Weight	1.1kg (2.42lb) (InfoRanger + Adapter)
Power supply	AC	Europe/Asia : AC 230V, 50Hz USA : AC 120V, 60Hz
	DC	Europe/Asia : +12V, 1.0A USA : +12V, 1.2A
Regulatory Agency Approval		FCC, UL / CUL, CE

RF Specifications

The InfoRanger uses the Conexant chip to follow MCNS specification. (SP-RFI-I03-980202)

Downstream

- 5.056941/5.360537M symbol rate
- Supports 64 and 256QAM
- Digital demodulator, Nyquist filters, tracking loops, and 32-tap adaptive decision feedback equalizer
- Digital derotator for wideband carrier phase tracking
- 16 state Trellis decoder
- Reed-Solomon(n, k) = (128, 122) ; t=3
- Programmable convolutional deinterleaver, I*J<=128
- 10 bit converter suitable to 256QAM applications

Upstream

- MCNS, IEEE802.14, DAVIC, DVB compliant
- Programmable modulation : QPSK, 16QAM
- Variable symbol rates up to 6.25 M symbol rate
- QAMLink modulator with (= 0.25/0.50 sq-root Nyquist filters)
- Digitally tunable IF center frequency up to 42 MHz
- 10 bit DAC, 200 MHz maximum sample rate
- Programmable transmitter pre-equalizer
- Programmable RS encoder, GF(256), T=0 to 10
- Programmable last RS codeword : fixed length, shortened
- Programmable 23 bit randomizer : polynomial, speed, type
- Programmable randomizer location : before/after RS encoder
- Programmable encoding : Differential/Non-Differential

Chapter 2
Prior to Installation

Chapter 2 Prior to Installation

This chapter explains what you should do before installing the InfoRanger.

Subscribing to Cable Internet Service

The cable modem receives data through a cable TV network. Therefore, it is necessary to subscribe Internet service to use your cable modem. If you are already subscribing to cable TV, please make sure that you are also subscribing to cable Internet service cable TV provider. If you do not have Internet service, please contact your cable TV provider and ask the following services.

- **Whether they support two-way cable modem access service or not.**
  - ☞ The InfoRanger enables two-way data transmission. If you want to use all features of the InfoRanger, you need to subscribe to your cable TV provider which provides two-way cable modem access service.

- **Whether they provide the Internet service or not.**
  - ☞ If you want to send or receive e-mails, access to WWW and/or use other Internet services through the cable modem, you need to have cable Internet service. Once you are an Internet service subscriber in your cable TV provider, it will provide you with an Internet account, which you can connect to via your cable modem. Please note that your Internet account should be established before the installation of cable modem.

Environment Preparation for Installation

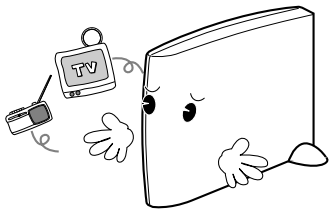
You should install the InfoRanger in a place with the following temperature, humidity and stable electric power.

- Operation temperature : 0 to 40℃(32°F to 104°F),
  Storage temperature : - 25 to 70℃(- 13°F to 158°F)
- Operation humidity : below 90% (40℃(104°F), non-condensing),
  Preservation humidity : below 90% (60℃(140°F), non-condensing)
- Power Consumption : 7Watt
- Input voltage : Europe/Asia:230VAC, USA:120V
- Rated frequency : Europe/Asia:50, USA:60Hz

CAUTION While the InfoRanger is operating, keep the fluctuation range of input voltage within 5% of regulated voltage. In addition, ground the electric outlet which is connected to input terminal.

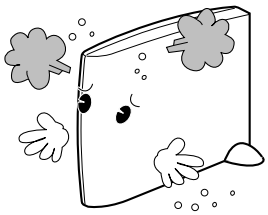
◆ Avoid static electricity and electric noise….

Use preventive equipment if the InfoRanger is installed in a place where high static electricity or electric noise is present.



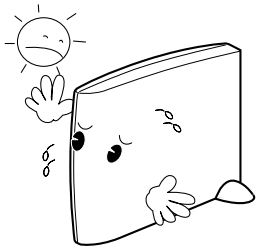
◆ Clean and well ventilated place….

Install the InfoRanger in a ventilated place where the appropriate temperature and airflow is present. As dust can cause a serious failure of operation, install the InfoRanger at a clean place.



◆ Avoid the direct sunlight

Direct sunlight can increase temperature of the InfoRanger and this can cause damage to operational parts and lead to operation failure. Therefore, Samsung recommends keeping the InfoRanger away from direct sunlight.



Preparing Necessary Items

The following items should be prepared in order to use the InfoRanger.

Included Items (InfoRanger SCM-120R)

- InfoRanger SCM-120R
- A power adapter
- A stand holder
- A RJ-45 Ethernet cable (1.8m (6Ft.))
- This manual

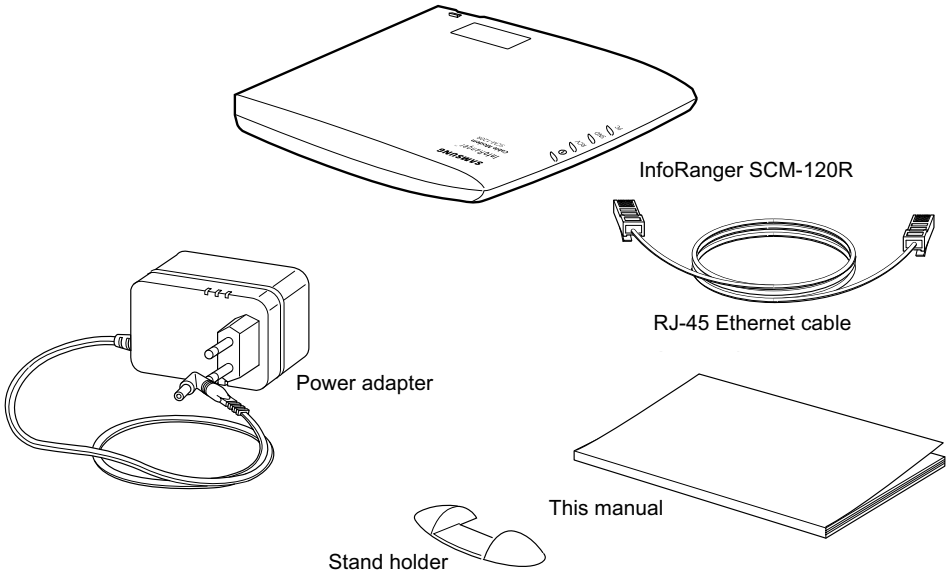


Figure 2-1 Included items in the InfoRanger package

NOTE The specification and the shape of the power adapter contained in the package are different according to the regions where the cable modem is purchased.

Not Included Items

The following items are not included in the InfoRanger package. These need to be prepared separately.

- An IBM compatible PC which TCP/IP is installed on and runs Windows 95 (or later) or a Macintosh which TCP/IP is installed on and runs System 7.5 (or later).
- A two-way coaxial cable
- A crossover cable for connecting hub
- A Network Interface Card (NIC)

Included Items (InfoRanger SCM-120U)

- InfoRanger SCM-120U
- A power adapter
- A stand holder
- A RJ-45 Ethernet cable (1.8m (6Ft.))
- A USB cable (1.8m (6Ft.))
- This manual
- USB Driver Floppy Diskette for USB port (used for both Windows 98 SE (Second Edition) and Windows 2000 environment)

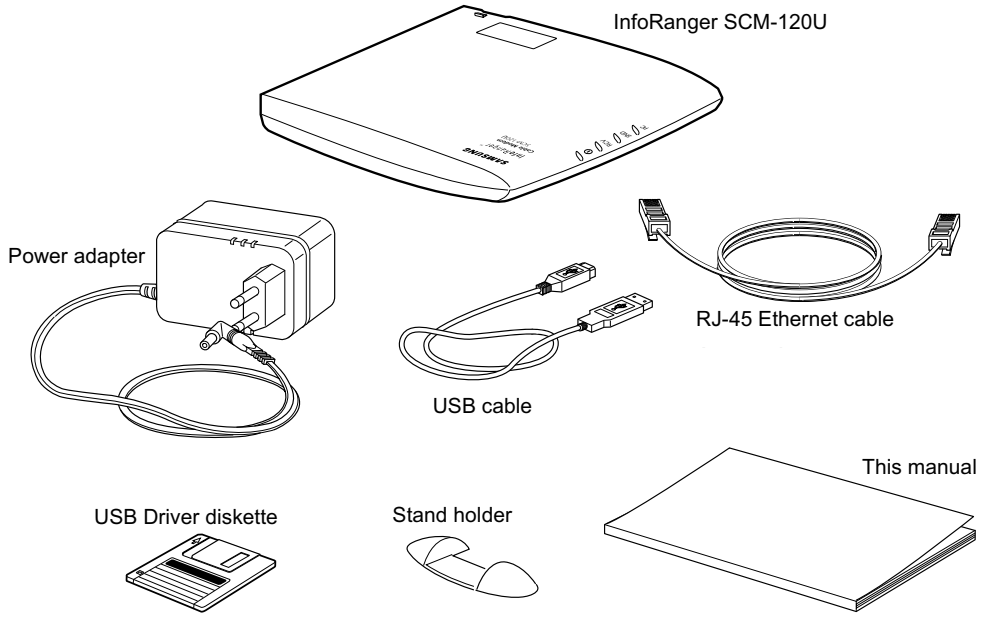


Figure 2-2 Included items in the InfoRanger package

NOTE The Specification and the shape of the power adapter contained in the package are different according to the regions where InfoRanger is purchased.

Not Included Items

The following items are not included in the InfoRanger package. These need to be prepared separately.

- An IBM compatible PC which TCP/IP is installed on and runs Windows 95 (or later) or a Macintosh which TCP/IP is installed on and runs System 7.5 (or later).
- A two-way coaxial cable
- A crossover cable for connecting hub
- A Network Interface Card (NIC)

Configuring TCP/IP Protocol

Once you have set-up the IBM compatible PC running on Windows 95 (or later) or the Macintosh running on System 7.5(or later), you need to install TCP/IP protocol and network interface card, only when using Ethernet port of InfoRanger.

You do not need to install TCP/IP protocol when using USB port of InfoRanger SCM-120U, because TCP/IP protocol is installed automatically while USB driver is installed. Skip this section and go to the next chapter when using USB port.

Referring to the manual that provided with your network interface card, please install the network interface card on your computer and install the network interface card driver. Then, install TCP/IP protocol as follows. If you already installed TCP/IP protocol, skip this section and go to the next chapter.

NOTE The TCP/IP protocol is installed automatically during Windows 2000 installation. Generally it is not necessary to install TCP/IP protocol in Windows 2000 environment unless you removed TCP/IP protocol on purpose.

Installing TCP/IP Protocol on IBM Compatible PC

NOTE This installation is an example of an IBM compatible PC running on Windows 98 SE (Second Edition)/2000. Installation of TCP/IP protocol may vary depending on the different operating system and/or a network interface card used and/or Cable Service Provider, but the overall process is generally similar. Contact the Cable Service Provider to install TCP/IP protocol accuately.

For Windows 98 SE

1. Click the **[Start]** button on the desktop, and click **Settings ➔ Control Panel**.
2. In <Control Panel> window, double click Network icon.
3. When <Network> window appears, click **[Add...]** button.
4. When <Select Network Component> window appears, click **Protocol** and then click **[Add...]** button.
5. When <Select Network Protocol> window appears, click Microsoft from the 'Manufacture' list and then click **TCP/IP** from the 'Network Protocols' list. Click **[OK]** button. Insert Windows 98 SE CD into CD-ROM drive and designate its location in case a pop up window requesting to insert Windows 98 SE CD appears. Otherwise you do not need to.
6. In <Network> Window, click **TCP/IP** from 'The following network components are installed' list and click **[Properties]** button.
7. When <TCP/IP Properties> window appears, click <IP Address> tab. On the <IP Address> tab, select **Obtain an IP address automatically** and then click **[OK]** button.
8. When the system reboot prompt message appears, click **[YES]** button.

For Windows 2000

1. Click the **[Start]** button on the desktop, and click **Settings ➔ Control Panel.**
2. In <Control Panel> window, double click **Network and Dial-Up Connections** icon.
3. When <Network and Dial-Up Connection> window appears, select **Local Area Connection** icon and press the right button of the mouse.
4. When <Local Area Connection Properties> window appears, Click **[Install]** button.
5. When <Select Network Component Type> window appears, select **Protocol** and then click **[Add...]** button.
6. When <Select Network Protocol> window appears, select **Internet Protocol (TCP/IP)** and click **[OK]** button. TCP/IP protocol is installed. While TCP/IP is installed, insert Windows 2000 CD into CD-ROM drive and designate its location in case a pop up window requesting to insert Windows 2000 CD appears. Otherwise you do not need to.
7. Select the newly installed **Internet Protocol (TCP/IP)** in <Select Network Protocol> window, click **[Properties]** button.
8. When <Internet Protocol (TCP/IP) Properties> window appears, select **Obtain an IP address automatically** and **Obtain DNS Server address automatically** then click **[OK]** button.
9. When the system reboot prompt message appears, click **[Yes]**. Otherwise, it is not necessary to reboot the system.

Installing TCP/IP Protocol on Macintosh PC

This installation is an example of a Macintosh running on System 8.5. Installation method of TCP/IP protocol may vary depending on the different operating system and/or a network interface card used and/or the Cable Service Provider, but the overall process is generally similar. Contact the Cable Service Provider to install TCP/IP protocol accuately.

1. Click the Apple icon and select the **TCP/IP** icon in the Control Panels.
2. In <TCP/IP> window, there are two menus, AppleTalk and Ethernet, in the Connect Via list. Select **Ethernet** in the list.
3. The Setup box is changed. There are 4 menus in the Configure list. Select **Using DHCP Server** in the list. Clicking this menu brings the IP address, router address to be set automatically by InfoRanger.
4. Close the window to finish the TCP/IP installation. When <Save changes to the current configuration?> message appears, click **[Save].**
5. If a message appears to restart the system, reboot the system. Otherwise you do not need to.

Chapter 3

Installing and Provisioning InfoRanger

Chapter 3 Installing and Provisioning InfoRanger

Installing InfoRanger

This chapter explains how to install the InfoRanger and how to connect the cables to the InfoRanger. The following describes the process.

1. Put the InfoRanger the appropriate place.
2. Connect the coaxial cable.
3. Connect to PC (Single PC / Multi PCs).
4. Connect the power adapter.

WARNING **Do not connect the InfoRanger's power adapter before connecting any cables to it.** It can cause serious damage to the equipment.

Locating in a place

NOTE The locating method is appicable to both InfoRanger SCM-120R and SCM-120U.

Locate InfoRanger in a flat surface away from direct sunlight. It is also necessary to put InfoRanger in a place close to the cable outlet or cable splitter for easier connection of cables. You can either stand InfoRanger by fixing the supplied stand holder into it or put it in a place, with its side where you can find a protrusion at the bottom. But it is strongly recommended that you stand it up to improve ventilation. To stand the InfoRanger, fix the stand holder into it as following:

1. There is a small protrusion at the lower right part on the front side (on which SAMSUNG logo is printed) of the InfoRanger. Also, there is another one at the lower left part on the backside of the InfoRanger. First, fix the protrusion on the backside of the InfoRanger into the narrow groove of the stand holder.

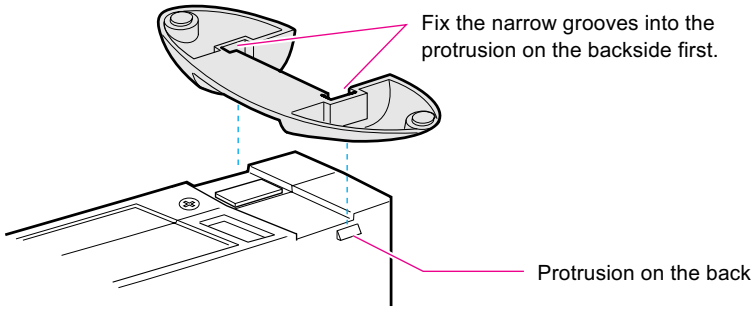


Figure 3-1 Fixing the protrusion on the front to the groove of the stand holder

2. Next, adjust the middle of the stand holder to the hollow part under the InfoRanger. Then, press the middle of the stand holder.

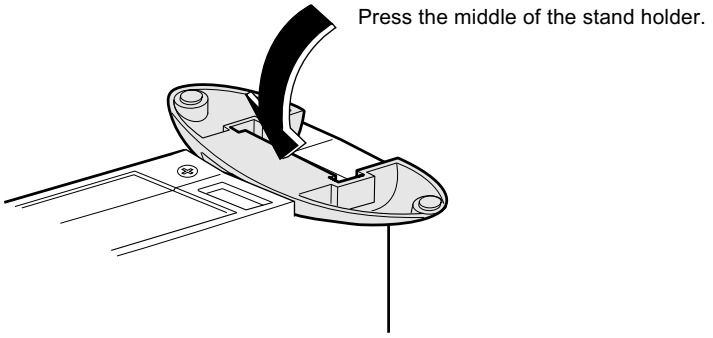


Figure 3-2 Press the stand holer to the InfoRanger

3. The InfoRanger with stand holder is described below.

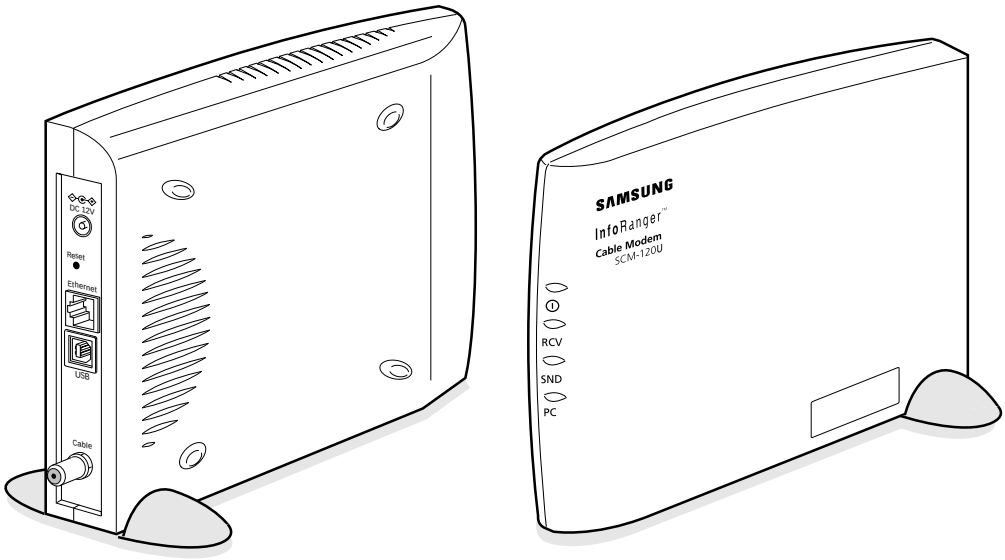


Figure 3-3 InfoRanger SCM-120U with stand holder

CAUTION Be sure to fix the stand holder into the InfoRanger with the proper attention. Failure to fix the stand holder into the InfoRanger accurately as is described in this chapter can break the stand holder.

Connecting the Coaxial Cable

NOTE The connecting method is applicable to both InfoRanger SCM-120R and SCM-120U.

Connect one end of the coaxial cable to the **Cable** connector of the InfoRanger and connect the other end of the coaxial cable to the cable outlet or cable splitter. Slide the pin in the center of the coaxial cable into the hole in the **Cable** connector carefully without bending, and turn the connector clockwise until the cable is firmly attached.

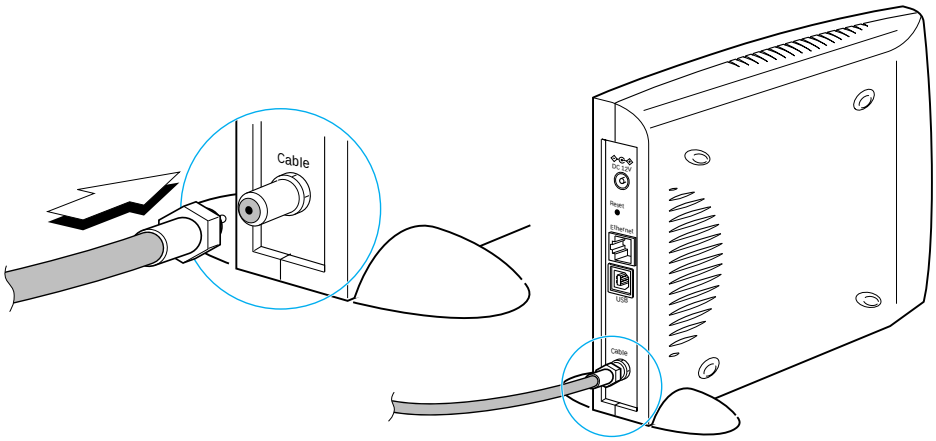


Figure 3-4 Connecting the coaxial cable to the Cable connector of InfoRanger SCM-120U

NOTE The coaxial cable is not provided with the InfoRanger by default.

Connecting PCs

You can connect the InfoRanger to a single PC or to group of PCs through a hub or a switch. You must use RJ-45 Ethernet cable (straight-through cable) or USB cable which are provided with the InfoRanger to connect the InfoRanger to PC. To connect additional PCs to the InfoRanger, you must prepare the additional Straight-through Ethernet cables, a hub, and a Crossover Ethernet cable.

You can use both Ethernet port and USB port at a time without any kind of specific operation when using InfoRanger SCM-120U.

NOTE Use Ethernet port and prepare Network Interface Card and a Hub to connect the InfoRanger to multiple PCs. You can connect the USB port of InfoRanger SCM-120U to only one PC at a time. Or, use both Ethernet port and USB port simultaneously.

NOTE It is possible to connect the InfoRanger SCM-120U and SCM-120R to multiple PCs by using USB port and Ethernet port at the same time, but the amount of PCs is dependent on the Cable Service Provider. Contact your Cable Service Provider for further information.

Single PC Connection

(1) Using Ethernet port

First, turn off the PC, which you connect to the InfoRanger. Connect the **Ethernet** port of the InfoRanger to the port of the network interface card on the PC using the RJ-45 network cable (provided with the InfoRanger).

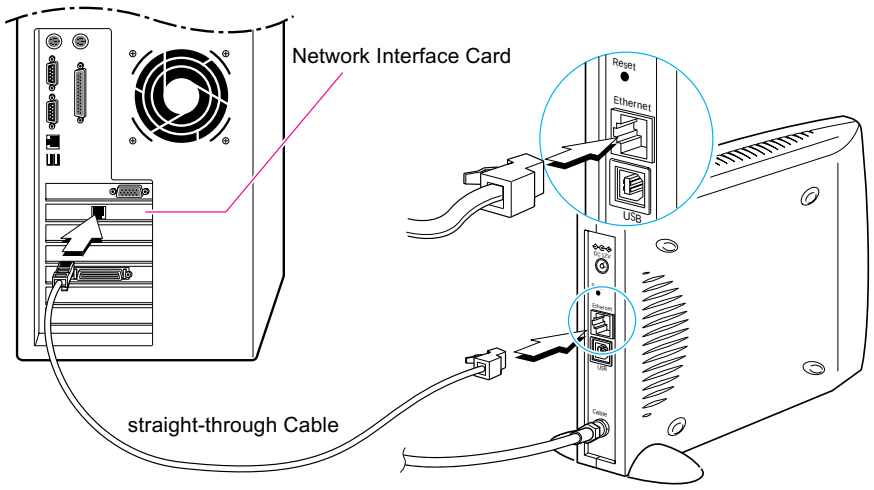


Figure 3-5 Connecting the RJ-45 Ethernet cable to the PC and the Ethernet port of InfoRanger SCM-120U

(2) Using USB port (Only for InfoRanger SCM-120U)

NOTE Use IBM compatible PC running Windows 98 SE (Second Edition)or later version such as Windows Me (Millenium Edition) and Windows 2000 in case of using USB port.

To use USB port, there should be a USB port in the PC supposed to be connected to InfoRanger. Make sure if there is a USB port in the PC most of all.
Connect the USB port of PC and the USB port of InfoRanger using USB cable, which is provided with InfoRanger. It is not necessary to turn off the PC to connect the PC to InfoRanger.

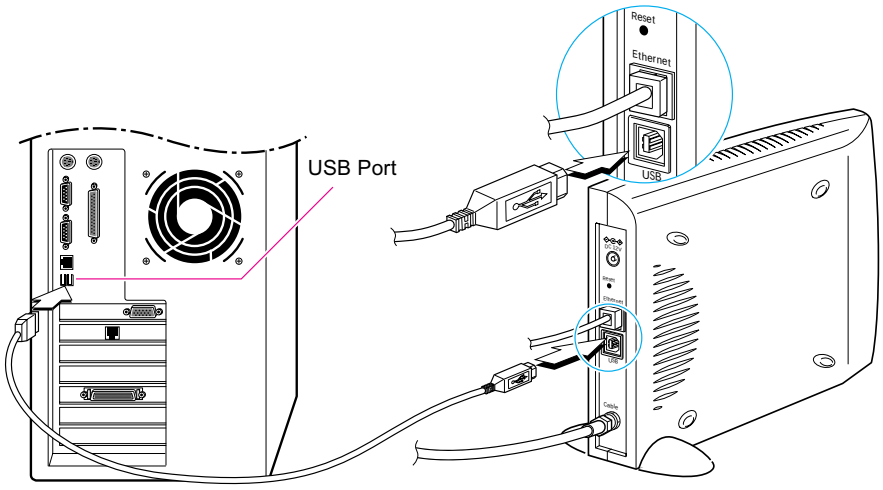


Figure 3-6 Connecting the USB cable to the PC and the USB port of InfoRanger SCM-120U

Install the driver for USB port

The final step for using USB port is to install the driver for USB port using USB driver diskette provided with InfoRanger. Do the following steps to install USB driver.

NOTE You can download a manual describing more in detail how to install USB driver for InfoRanger SCM-120U in www.samsungnetwork.com.

▲ For Windows 98 SE

1. When you connect the InfoRanger and PC, the <Add New Hardware Wizard> window appears. Click **[Next]** to go on to the next step.
2. Select **Search for the proper driver for your device (Recommended)** in the following window, and click **[Next]** to go on to the next step.
3. Select **Floppy Disk Drive** as a location of a new driver and insert the USB driver diskette provided with InfoRanger into floppy disk drive. Click **[Next]**.
4. Select **Use an updated Driver (Recommended)-Samsung Cable Modem USB Driver** in the following window, click **[Next]** to go on to the next step.
5. A window appears reporting it has found the appropriate driver in the floppy disk as following. Click **[Next]** to go on to the next step.
6. Click **[Next]** in the following window which reports it is ready to install Samsung Cable Modem USB Driver. Insert Windows 98 SE CD into CD-ROM drive during installation when a message appears requesting to insert Windows 98 SE CD into CD-ROM drive. Click **[Next]** when CD-ROM is ready.
7. Click **[Finish]** to finish the installation process and restart the system.

▲ **For Windows 2000:**

1. When you connect the InfoRanger and PC, the <Found New Hardware Wizard > window appears. Click **[Next]** to go on to the next step.
2. Select **Search for a suitable driver for my Device (Recommended)** in the following window, and click **[Next]** to go on to the next step.
3. Select **Floppy Disk Drive** as a location of a new driver and insert the USB driver diskette provided with InfoRanger into floppy disk drive. Click **[Next]**.
4. In this step, a window appears reporting it has found the suitable driver in the floppy disk. Click **[Next]** to go on to the next step.
5. When an window alarming **Microsoft Digital Signature** is not included in the software, just click **[Yes]** to proceed installation.
6. Click **[Next]** in the window which reports it is ready to install the driver.
7. Insert Windows 2000 CD into CD-ROM drive during installation when a message appears requesting to insert Windows 2000 CD into CD-ROM drive. Click **[Next]** when CD-ROM is ready. Files are copied from Windows 2000 CD.
   If no message appears, skip this step.
8. Click **[Finish]** to finish the installation process. It is not necessary to restart the system in the Windows 2000 environment.

Uninstall the driver for USB port

If necessary, do the following steps to uninstall USB driver.

You can download a manual describing more in detail how to uninstall USB driver for InfoRanger SCM-120U in www.samsungnetwork.com.

▲ **For Windows 98 SE**

1. Click the **[Start]** button on the desktop, and click **Settings ➔ Control Panel**.
2. In **<Control** Panel> window, double click **Network** icon. You can check the **Samsung Cable Modem USB Driver** item in the configuration list.
3. Select the **Samsung Cable Modem USB Driver** and click **[Remove]**. The USB driver is removed. Then, reboot the system. When the system is restarted, the following items required deleting to completely uninstall the driver.
   a. File named **C:\Windows\System, NetSecCm.sys**
   b. File named **C:\Windows\INF\Other, SamsungNetSecCm.inf**
4. After deleting the two files, reboot the system one more time.

▲ **For Windows 2000**

1. Click the **[Start]** button on the desktop, and click **Settings ➔ Control Panel**.

2. In <Control Panel> window, double click **Add/Remove Hardware** icon to launch <Add/Remove Hardware Wizard> window. Click **[Next].**

3. In the next window, select **Uninstall/Unplug a device** and click **[Next]** to go on to the next step.

4. In the next window, select **Uninstall a device** in order to load the item list to uninstall. If **Samsung Cable Modem USB Driver** does not exist in the list, check the **Show hidden device** under the list box to bring up all the devices. Select **Samsung Cable Modem USB Driver** and click **[Next]** to go on to the next step.

5. In the next window, select **Yes, I want to uninstall device** and click **[Next].** The USB Driver is uninstalled.

6. Click **[Finish]** to finish the <Add/Remove Hardware Wizard>.

7. Now launch **Registry Editor**; From **[Start]** menu, select **Runs..** then type **regedit** on the command line. Delete the following: **HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Enum\USB\Vid_04E8&Pid_0120**

8. Exit the Registry Editor and launch the **Windows Explorer**. Find and delete one **oemX.inf**(X=0,1,2,3…) file under **C:\WINNT\INF**, which contains a note '**Samsung SCM-120U/E USB CABLE MODEM**' at the beginning. Moreover, you need to an **oemX.pnf**(X=0,1,2,3…) file correspond to the deleted oemX.inf file, for example, if you deleted oem3.inf file, delete oem3.pnf file as well.

9. Finally, delete **NetSecCm.sys** under **C:\WINNT\System32\Drivers**.

10. USB uninstallation process is finished. Reboot the system.

The attribute of C:\WINNT\INF folder and ***.inf** files are hidden, so that they may invisible in the Windows Explorer. In this case, click **Tools ➔ Folder Option** of the Windows Explorer and select **View** tab. In the configuration list, open the **Hidden File and Folders folder** and check the **Show hidden file and folders**. Now that the attribute of INF folder and *.inf files are changed, you can see them in the Windows Explorer.

Multiple PCs Connection

The amount of PCs is dependent on the Cable Service Provider. Contact your Cable Service Provider for further information.

If you want to connect more than one PC to the InfoRanger, you need to prepare the following additional items:

- An Ethernet hub or switch of 10/100Mbps transmission speed
- Twisted pair category-3,4,5 crossover cable
- Twisted pair-category-3,4,5 straight-through cables equal to the number of PCs

The specifications of twisted pair category-3,4,5 crossover cables and straight-through cables are described at Appendix D in detail.

NOTE You can connect the InfoRanger to fifteen PCs simultaneously by using Ethernet port.

NOTE If the user needs more than one straight-through cable to connect multiple PCs to InfoRanger, he/she should prepare the necessary cables by himself/herself because only one straight-through cable is supplied with InfoRanger by default.

After preparing all the things to connect additional PCs, do the followings.

1. Turn off all the PCs you want to connect to the InfoRanger.

2. Connect one end of twisted pair category-3,4,5 **crossover** cable to the **Ethernet** port of the InfoRanger. Then, connect the other end of cable to the port of hub.

3. Connect one end of twisted pair category-3,4,5 **straight-through** cable to the port of network interface card installed on PC. Then, connect the other end of cable to the port of hub.

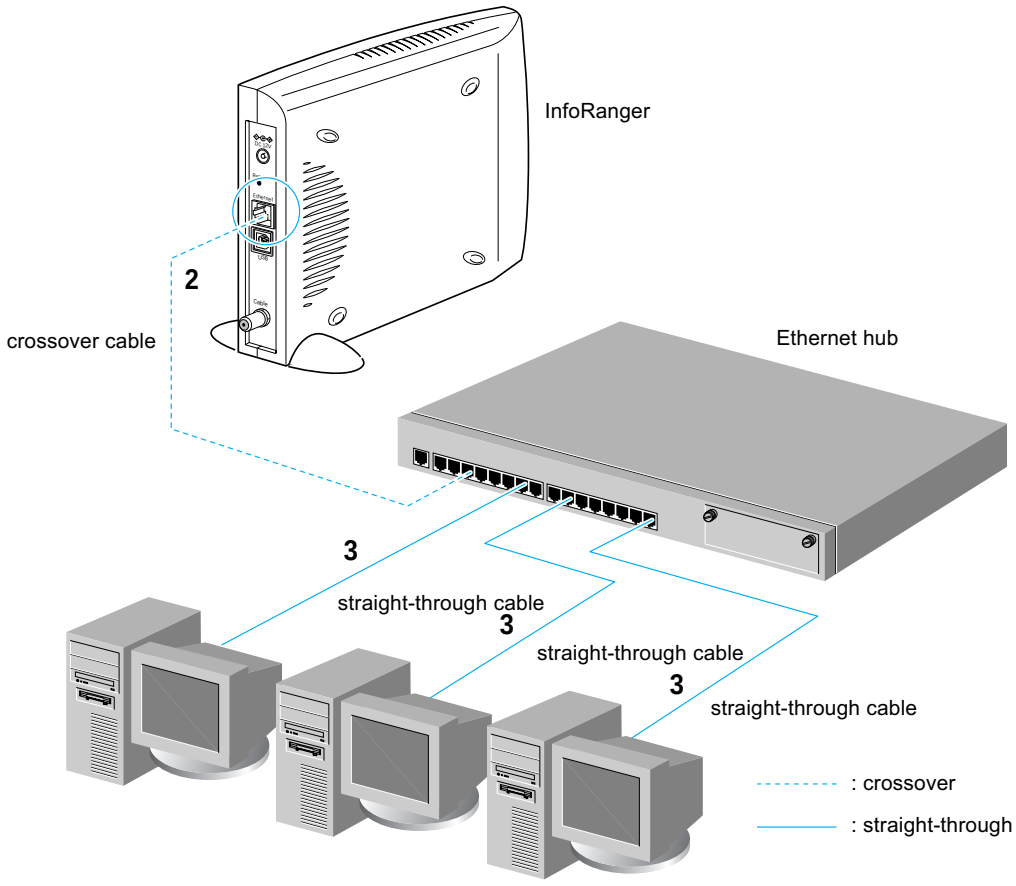


Figure 3-7 Connecting the InfoRanger SCM-120U to multiple PCs through an Ethernet hub

Connecting the Power Adapter

NOTE The connecting method is appicable to both InfoRanger SCM-120R and SCM-120U.

WARNING **Do not connect the InfoRanger's power adapter before connecting any cables to it.** It can cause serious damage to the equipment.

Be sure to connect the power adapter to the InfoRanger only after connecting other cables.
Connect one end of the power adapter to **DC 12V** jack of the InfoRanger and the other end to a wall outlet as follows.

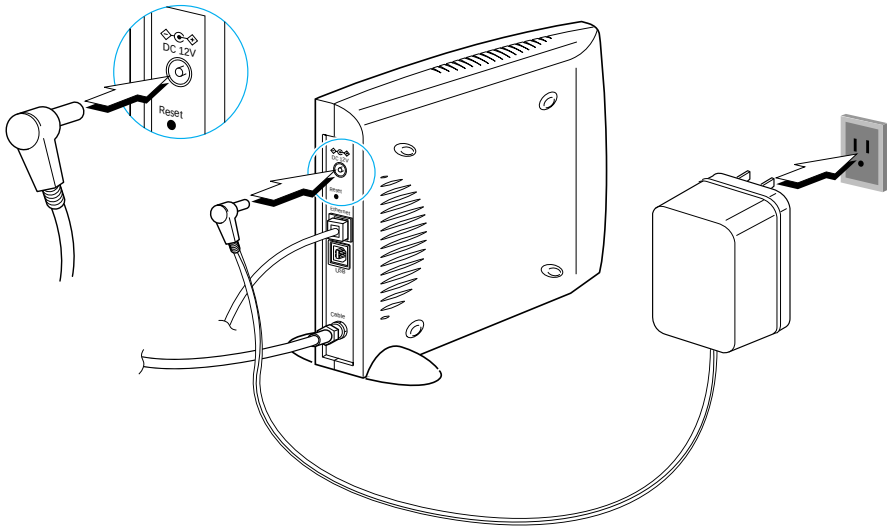


Figure 3-8 Connecting the power adapter to the InfoRanger SCM-120U

CAUTION Use only the power adapter supplied with the InfoRanger. Using other type of power adapter can cause critical damage to the InfoRanger.

NOTE The Specification and the shape of the power adapter contained in the package are different according to the regions where InfoRanger is purchased.

Inspecting Cable Connection

The following diagram shows the correct cable connections.

NOTE This disgram shows an example of using the Ethernet port of InfoRanger SCM-120U. The network configuration using InfoRanger SCM-120R is identical to it. In case of InfoRanger SCM-120U, you con even cofnigure the network using the USB port instead of Ethernet port.

Single PC Connection

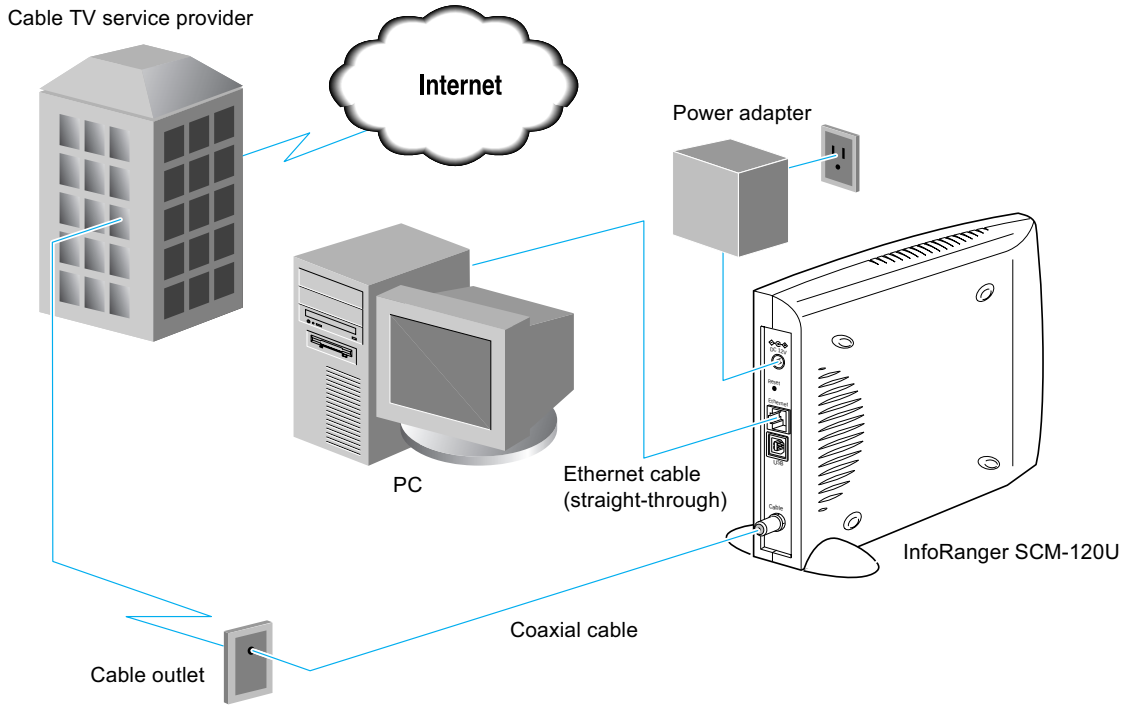


Figure 3–9 Cable connection in case of a singal PC connection

NOTE The above diagram is showing the case of connecting the PC to Ethernet port of InfoRanger. The case of connecting the PC to USB port of InfoRanger is identical.

NOTE The Specification and the shape of the power adapter contained in the package are different according to the regions where InfoRanger is purchased.

Multiple PCs Connection

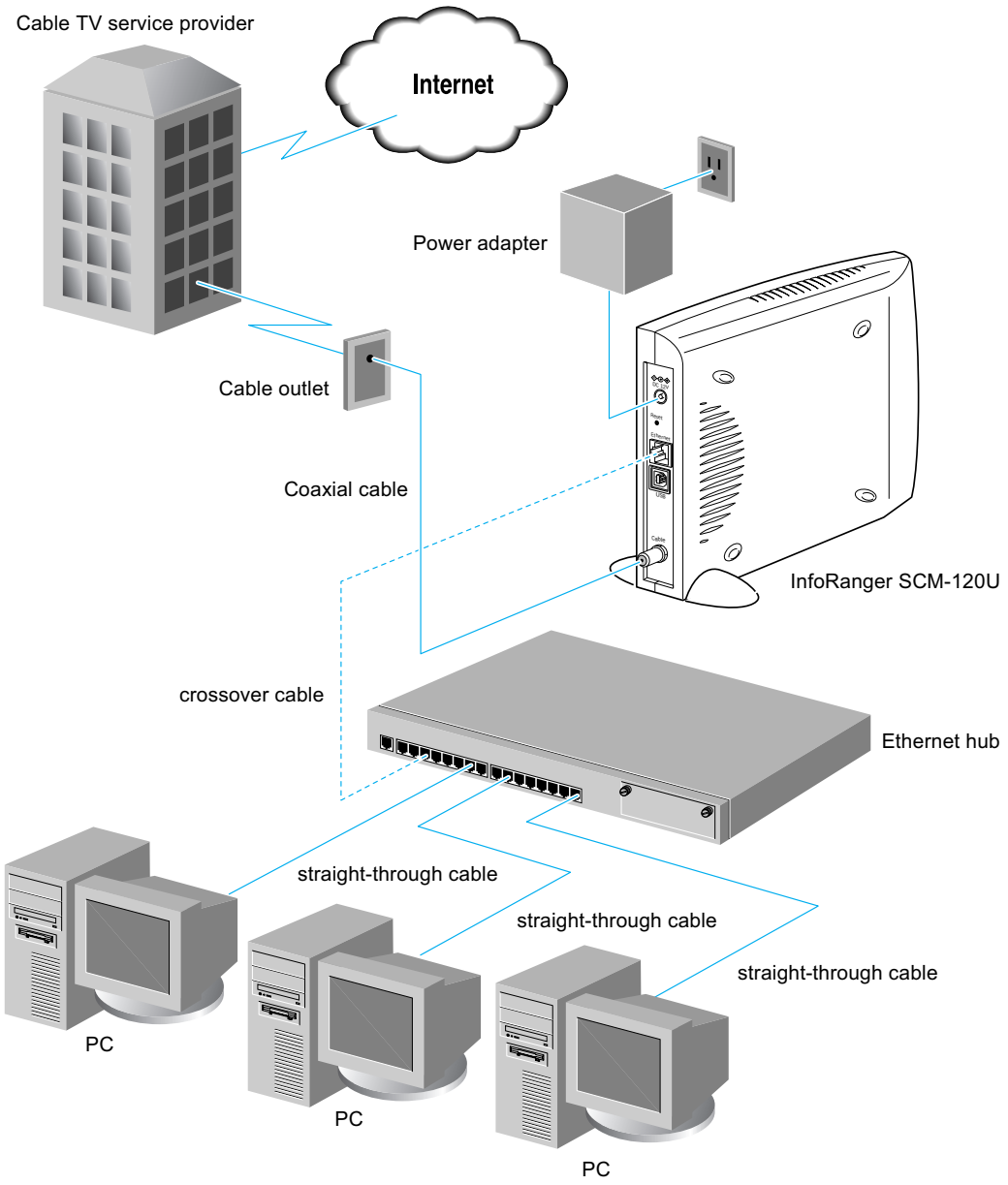


Figure 3-10 Cable connection in case of multiple PCs connection

NOTE The Specification and the shape of the power adapter contained in the package are different according to the regions where InfoRanger is purchased.

Provisioning InfoRanger

Procedure of Provisioning InfoRanger

The InfoRanger initialization process is as follows :

1. Power on and Initialization Sequence.
2. Scanning and Synchronize with Downstream Channel.
3. Obtain Upstream Parameters.
4. Ranging.
5. Establish IP Connectivity.
6. Transfer Operational Parameters.
7. Registration.
8. Enable Ethernet Interface.
9. Baseline Privacy Initialization.

Power on and Initialization Sequence

Once a system image is loaded by the boot function, the initialization function performs platform and VxWorks initialization functions including but not limited to :

- Copy data segment of image to DRAM.
- Initialize system clock.
- Initialize various physical devices (e.g. cable CN9414, LXT972).
- Initialize interrupt handler support.
- Initialize VxWorks kernel functions (e.g. memory and list management).
- Initialize scheduler.
- Initialize various processes.
- Initialize Rx and Tx buffers and buffer descriptor rings for cable, Ethernet and USB interfaces.
- Start scheduler.

Upon completion of platform and operating environment initialization, initialization continues at a system level as per MCNS specification [SP-RFI] and is performed largely by the Cable MAC Control function and the Cable MAC hardware but also includes participation by the DHCP function and, possibly, the TFTP function.

Scan and Synchronize With Downstream Channel

The first step in the InfoRanger initialization is the acquisition of a downstream channel. If the InfoRanger has previously acquired a downstream channel, this information must be stored in non-volatile memory device and the InfoRanger must first attempt to re-acquire its previously used channel. If acquisition of the previously used channel fails or if there is no previous operational data in non-volatile memory device, the InfoRanger continually scan the channels in the downstream frequency range until it finds a valid downstream signal.

A downstream channel is considered to be valid when the InfoRanger has achieved:

- synchronization of QAM symbol timing (PHY)
- synchronization of MPEG stream (PHY)
- recognition of SYNC MAC messages (MAC)

In the event that more than one downstream signal is present in the system, the InfoRanger must operate using the first valid downstream signal that it encounters when scanning. If necessary, the InfoRanger is instructed to change to a different downstream channel via the optional parameters file.

Obtain Upstream Parameters

After acquiring a downstream channel, the InfoRanger waits for an Upstream Channel Descriptor (UCD) message. This type of message is transmitted periodically from the CMTS and is addressed to the MAC broadcast address. There is a separate UCD transmitted for each available upstream channel.

The InfoRanger determines if a particular upstream channel is suitable based on parameters included in the UCD message (e.g. modulation = QPSK or 16QAM). Once a suitable upstream channel is found, the InfoRanger extracts the channel parameters from the UCD, waits for the next SYNC message and extracts the upstream mini-slot time stamp. The InfoRanger then waits for a bandwidth allocation message (MAP) for the selected upstream channel before it can proceed with the next initialization process. The InfoRanger may be instructed to change to a different upstream channel via the optional parameters file.

Ranging

The next step in InfoRanger initialization is the ranging process where the InfoRanger acquires a timing offset such that its transmissions are aligned correctly on upstream mini-slot boundaries. This relates to the distance of the InfoRanger from the CMTS. When a MAP is received for the particular upstream channel that the InfoRanger has selected for transmissions, it sends a Ranging Request (RNG-REQ) message in the broadcast Initial Maintenance time slots defined in the MAP. The SID used at this time is the one reserved for non-initialized InfoRanger. The CMTS responds with a Ranging Response (RNG-RSP) message addressed specifically to the InfoRanger by means of the InfoRanger MAC address. The response contains information on RF power level adjustment and timing offset corrections as well as a temporary SID that the InfoRanger uses for the remainder of the initialization process. The InfoRanger then waits for a MAP message describing unicast Station Maintenance mini-slots specific to the temporary SID.

Another RNG-REQ message is transmitted in those mini-slots containing power level and timing offset corrections. The CMTS responds with another RNG-RSP message to the InfoRanger with any additional fine tuning information required. If this RNG-RSP does not contain a Ranging Successful notification, the procedure starts with the unicast Station Maintenance RNG-REQ (i.e. procedure does not repeat from first RNG-REQ).

Ranging parameter (e.g. transmit power) adjustments have the following restrictions:

- All parameters must be within approved range at all times.
- Power adjustment must start from the minimum value unless a valid power is available from non-volatile storage, in which case this value must be used as a starting value.
- Power adjustment must be capable of being reduced or increased in response to a RNG-RSP message.
- If power is adjusted to maximum value, it must wrap back to minimum value.

Establish IP Connectivity

At this point the DHCP function attempts to obtain an IP address for the InfoRanger. In addition to an IP address and other IP layer information, the DHCP response must contain the name of a file which contains further configuration parameters.

The following are required in the DHCP response:

- IP address to be used by the InfoRanger
- Subnet mask to be used by InfoRanger
- Hardware type should be set to Ethernet
- Gateway address if DHCP server is on a different network
- Name of the InfoRanger configuration file to be obtained from TFTP server by the InfoRanger
- Time offset of the InfoRanger from Universal Coordinated Time used by the InfoRanger to calculate local time
- A list of [RFC-868] time-servers from which the current time may be obtained
- IP address of security server if security is required

Transfer Operational Parameters

After the IP connection has been completed, the InfoRanger must download the InfoRanger configuration file. This is a binary file in the same format defined for DHCP vendor extension data in RFC-2132 and contains mandatory and vendor-specific options.

Parameters include:

- Downstream frequency option
- Upstream channel ID option
- Authentication string option (as per MCNS security specification; may no longer be mandatory)
- Network access option
- Quality of service option
- Modem capabilities option
- Vendor ID option
- TFTP download server
- Software upgrade file name

Registration

Once the InfoRanger has obtained its optional parameters, it conveys these parameters to the CMTS in a Registration Request (REG-REQ) message to which the CMTS replies with a Registration Response (REG-RSP) message containing a permanent SID.

Enable Ethernet Interface

During the previous steps, the InfoRanger holds the Ethernet in a disabled state. Once the registration procedure is completed and the network access option indicates that the InfoRanger can access the network, the Ethernet interface is enabled. The system is now initialized and data traffic may flow in both the upstream and downstream directions.

The System Initialization functional unit communicates with the following functional units:

- **Cable MAC Control/Baseline Privacy**
  ☞ to initiate ranging/registration procedures.
- **DHCP**
  ☞ to initiate DHCP procedure once upstream and downstream channels are acquired.
- **TFTP**
  ☞ to initiate download of optional parameters file.

Baseline Privacy Initialization

The baseline privacy functional unit exchanges security message with the CMTS to support a security system that is proposed by MCNS. Baseline privacy is described in the MCNS Baseline Privacy Specification.
The MCNS baseline privacy protocol uses single DES encryption on data payloads only. Cable MAC management messages are not encrypted.

The encryption is performed using DES keys on a per session basis. A service is uniquely identified by a Service Identifier (SID). Cable MAC management messages are not encrypted nor are any cable MAC headers. Encryption key exchange between CMTS and the InfoRanger is accomplished using the public-private RSA key exchange mechanism. Encryption keys are 56 bits in length or, optionally, 40 bits if export restrictions apply.

Each session has two corresponding semi-static DES encryption keys referred to as the odd and even keys. Since the current MCNS MAC header for data does not contain a SID field, the extended header option is required to support the per-session concept for encryption in both the downstream and upstream. The baseline privacy protocol defines new extended header types for this purpose. The security extended header contains protocol version information, the SID, and status bits indicating whether encryption is enabled or disabled and which of odd or even key should be used to decode a given data.

The InfoRanger supports the ability to verify its version of software against the currently specified “correct” version for the network during the InfoRanger initialization sequence and to download a new software image if necessary. The TFTP configuration file provides information about the current software version. If the version does not match the current configuration, the InfoRanger automatically downloads the new software version using the information provided in the TFTP option file. The initialization sequence takes about 180 seconds or less.

The InfoRanger is capable of recovering a software download that fails for any reason (e.g. network errors or power failure) from failing-over to the last operational copy of system software. The unit stores two versions of operational software permitting a restart with the previous (protected fallback) version of software in the event a software download fails. The system configuration is stored in NVRAM and optional parameters are obtained, as specified under MCNS, from a DHCP/TFTP server.

The InfoRanger has a reset switch that re-initializes, authenticates and authorizes the modem with the network. This switch performs the function of power cycling the InfoRanger. When the switch is pressed, the system reloads of system software, configuration parameters and subsequent authenticates and authorize with the network

Chapter 4
Using InfoRanger

Chapter 4 Using InfoRanger

This chapter explains features of the LEDs and the connectors of the InfoRanger.

Front View

There are 4 LED indicators on the front side of the InfoRanger.

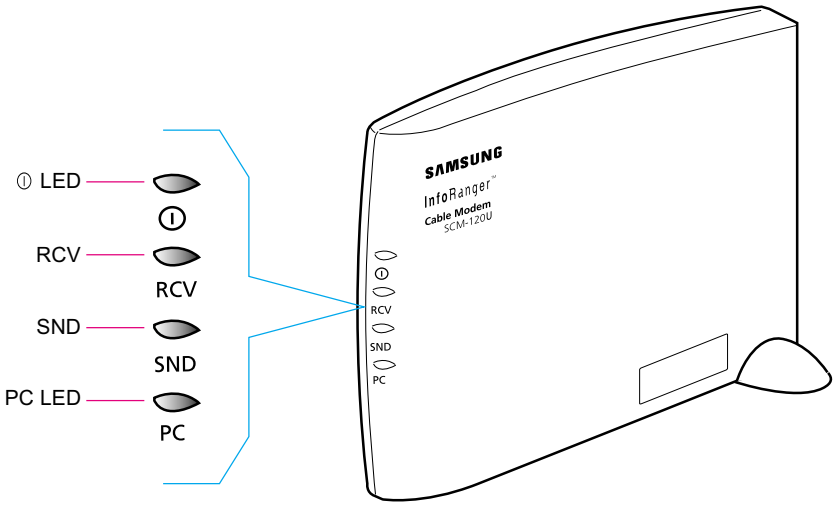


Figure 4-1 Front view of the InfoRanger SCM-120R and SCM-120U

NOTE When you connect the power adapter to the InfoRanger, a green light is on ⏻ LED first, and the InfoRanger processes Self diagnosis ➔ Initialization for receiving ➔ Initialization for sending ➔ Registering modem and Authentificating services. While these processes are running, the RCV LED and SND LED blinks. When this process is complete and the InfoRanger operates normally, the ⏻ LED, RCV LED, and SND LED light and remain green, and PC LED starts blinking. After you connect the Ethernet cable to the Ethernet port of InfoRanger, the PC LED also turns on steady green.

The simple meaning of each LED is as follows:

LED	Green
⏻	Indicates that the power is provided to InfoRanger normally
RCV	Indicates InfoRanger is locked, initialization process, Receiving Data
SND	Indicates InfoRanger is locked, initialization process, Sending Data
PC	Indicates Ethernet link status is fine

⏻ LED (POWER LED)

☞ When the power is provided to the InfoRanger's, the green light turns on in ⏻ LED. The ⏻ LED is turned off when the power is not provided to the InfoRanger.

Color	Description	
Green	ON	Power is provided
	OFF	No Power

RCV LED (RECEIVE LED)

☞ The green RCV LED blinks during modem initialization, which means scanning a downstream (receiving) channel. When the scanning is complete, the green RCV LED remains continuously lit as long as the modem is locked on the channel. The RCV LED is turned off when the modem stops working. The green RCV LED blinks fastly to indicate the modem is receiving data through the cable network.

Color	Description	
Green	ON	Channel Locked
	Blinking	Low speed : Channel scanning, Fast speed : Receiving data

SND LED (SEND LED)

☞ The green SND LED blinks during initialization (channel ranging) for transmitting data (upstream). When ranging is complete, the green SND LED turns green and remains continuously lit. The SND LED is turned off when the modem stops working. The green SND LED blinking fastly when the modem is sending data.

Color	Description	
Green	ON	Ranging Locked
	Blinking	Low Speed : Channel ranging Fast Speed : Sending Data

PC LED

☞ The PC LED lights green and blinks when the InfoRanger comes online and turns on when the Ethernet link between the PC and InfoRanger is normal. The PC LED turns off when the Ethernet link goes offline.

Color	Description		Misc.
Green	Blinking	Online	Ethernet/USB Link
	ON	Link OK	
	OFF	Offline	

If the SND LED, RCV LED and the PC LED are off while you are using the InfoRanger, check to see if the cable and the Ethernet cable/USB cable (only for InfoRanger SCM-120U) are not connected to the CABLE connector and Ethernet port/USB port properly.

Rear View

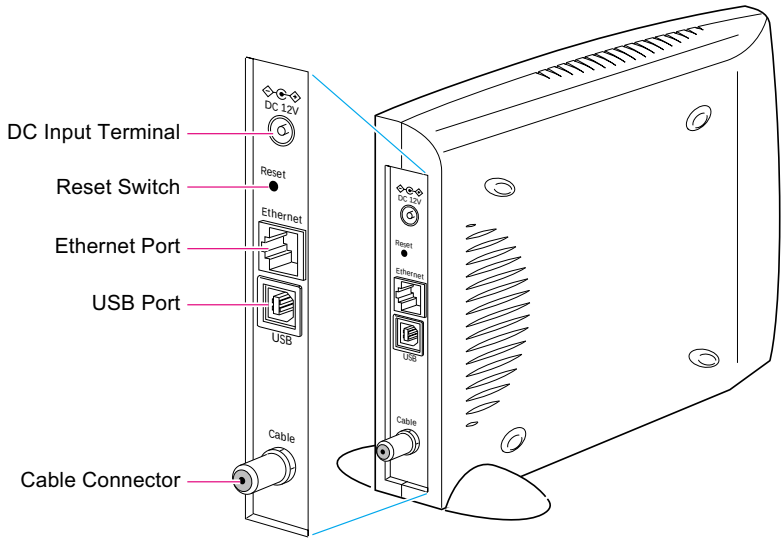


Figure 4-2 Rear View of the InfoRanger SCM-120U

CABLE Connector

☞ This is used to connect the coaxial cable to the cable outlet or the cable splitter.

Reset Switch

☞ This is used to initialize the modem.

Ethernet Port

☞ The InfoRanger supports up to 40Mbps to download data and also up to 10Mbps to upload data with this Ethernet port. This port is connected to the network interface card installed on PC or a hub or a switch if it is connected to multiple PCs using the Ethernet cable.

USB Port (Only for InfoRanger SCM-120U)

☞ This is a USB port with supports up to 12Mbps. This port is connected to the USB port of PC.

DC Input Terminal

☞ This is an input terminal, which provides DC 12V to the InfoRanger through the power adapter.

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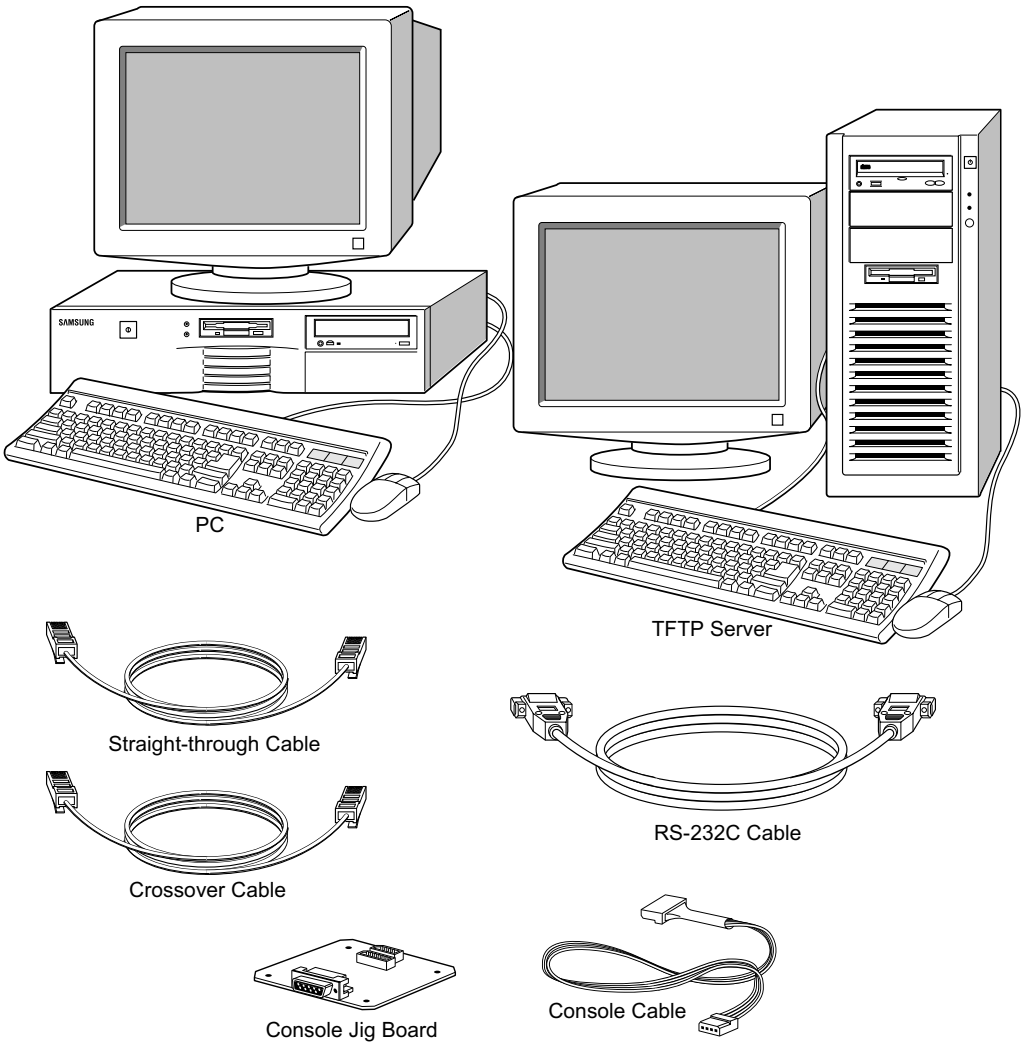
Chapter 5
Using Diagnostics Program

Chapter 5 Using Diagnostics Program

Equipment Preparation

- PC
- TFTP Server (PC or Workstation)
  - Image file
  - Bootrom file
- RS-232C cable (connector : female to male, DB9)
  - for connecting a PC and the InfoRanger
- Console jig board (provided by Samsung)
- Console cable (provided by Samsung)
  - for connecting a console jig board connector and the InfoRanger
- Ethernet cable (straight-through, crossover)
  - crossover cable : for connecting a hub and the InfoRanger
  - straight-through cable : for connecting a TFTP Server and the InfoRanger



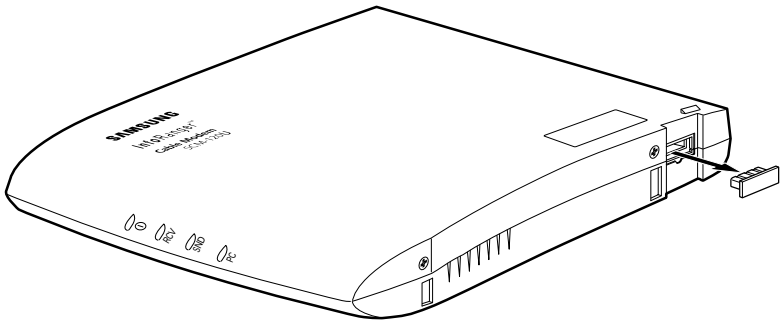
Functional Test

Set Up

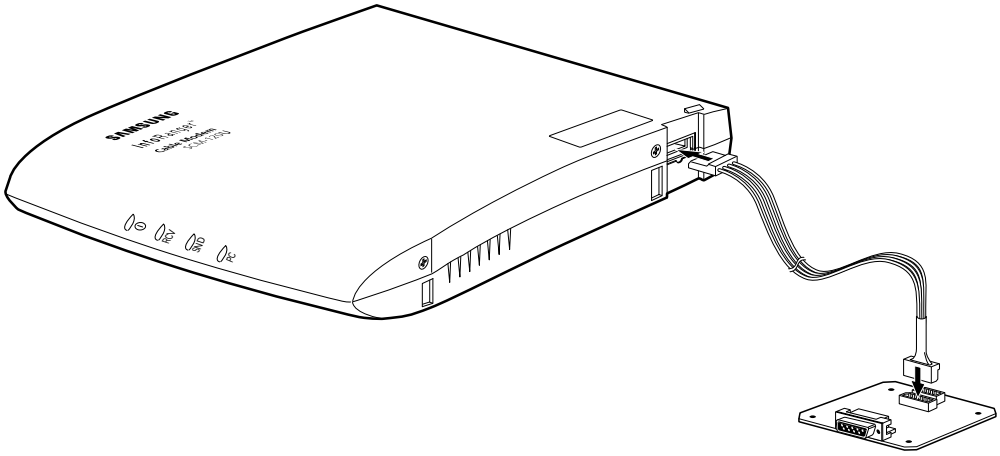
Connecting Equipments

Once you have all equipment ready, connect them according to the following instructions:

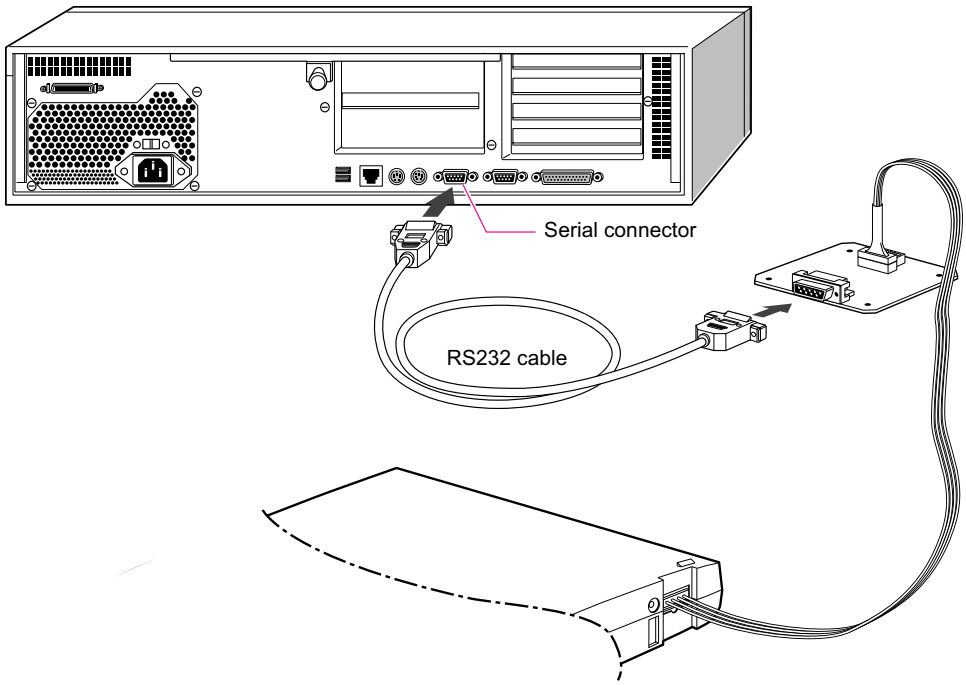
1. First, get rid of the stand holder under the InfoRanger to discover a small black rubber cap. Take out the rubber cap to expose the port 602 (P602). Keep the rubber cap in a safe place because you need it after the test.



2. Plug one end of the console cable into the P602 (4-pin) connector under the InfoRanger and the other to the p3 (6-pin) connector of the console jig board.



3. Connect the RS-232C cable to the serial connector (P1) on the console jig board and to the serial connector (COM1 or COM2) of the PC.



4. Set up Hyper Terminal of PC with :
   - Bps : 19200
   - Data bit : 8
   - Stop bit : 1
   - Parity : None
   - Flow control : None

5. Connect the power adapter to the DC 12V connector on the InfoRanger.

RS-232C Cable (Female to male)

Connector A		Connector B
2pin	◄——►	2pin
3pin	◄——►	3pin
5pin	◄——►	5pin

Starting Diagnostic Program

After connecting all the equipment, run the diagnostic program by doing the following:

1. The following message should appear momentarily on the Hyper Terminal. Press the [Enter] key in this screen.

```
Diagnostic S/W for SCM Series           Ver 0.0.0

S A M S U N G  E L E C T R O N I C S

Information & Communication Business.

Network Division BNT group



Press a key to start hardware diagnostics.
                . . . . . .
                >>  ☞ Press the Enter key.
```

2. Then, the following main menu of the diagnostic program appears.

```
START
============================
a.  Memory Test
b.  Ethernet Test
c.  Miscellaneous Test
d.  Cookie
e.  Cable Downstream Test
f.  Cable Upstream Test
ESC. Exit
============================
```

Introduction to Diagnostic Program Menu

The main menu of the InfoRanger diagnostic program consists of six different functional menu groups. Each group contains sub menus whose functions can be summarized as follows:

- **Memory Test**: Diagnose the memory on board.
- **Ethernet Test**: Diagnose the Ethernet.
- **Miscellaneous Test**: Blink the LED of the InfoRanger.
- **Cookie**: Display cookie content and reconfigure.
- **Cable Downstream Test**: Test the downstream status.
- **Cable Upstream Test**: Test the upstream status.

Using Diagnostic Program

The InfoRanger diagnostic program is a menu type program where you press the key corresponding to each menu. The following instructions are the basics of using the menu type diagnostic program.

Executing Menu

To execute a menu or sub menu, enter the letter in front of that menu on the keyboard.

For example, to view sub menus under the **Memory Test** menu from the main menu screen, you should enter 'a.'

Returning to Parent Menu

To return to a parent menu from a sub menu, press 'Esc.' Pressing 'Esc' on the main menu exits the diagnostic program.

Memory Test Menu

The Memory Test menu consists of 2 menus to diagnose memory of the InfoRanger. Let us find out how to use each menu. Enter 'a' from the <START>menu to start Memory TEST.

```
Memory TEST  MENU
======================
a.   Flash Memory Test
b.   SDRAM Memory Test
ESC. Exit
======================
```

Flash Memory Test

1. Start the 'Flash Memory Test' menu by entering 'a' from the <Memory TEST MEMU>. Then the <Flash TEST SUB MEMU> appears in the screen.

```
Device_id is : C5
INTEL 28F320 was detected
Flash ID is C5

Flash TEST SUB MENU
============================
a.   Erase Flash
b.   Write Flash
c.   Flash ID Detect
d.   Display Flash
e.   Copy from Flash to Flash
ESC. Exit
============================
```

2. Let us view the each of the sub menu.

Do not test related to Flash memory working in the Field. The task results in erasing the Running Image 1, 2 stored in the Flash memory. You have to take the trouble to download the Running Image 1, 2 from the TFTP server if they are erased.

Erase Flash

1. Run the 'Flash Erase' menu by entering 'a' from the <Flash TEST SUB MENU> menu. This function erases all the data stored in the Flash memory.

2. While the 'Flash Erase' is running, the processing status is displayed in the screen as below. The <Flash TEST SUB MENU> reappears when the task is completed. If the execution fails, the address and data where the error occurs appear in the screen.

```
0          1          2          3          4          5          6
0123456789 0123456789 0123456789 0123456789 0123456789 0123456789 0123
SSSSSSSSSS SSSEEEEEEE EEEEEEEEEE EEEEEEEEEE EEEEEEEEEE EEEEEEEEEE EEES
PASS

Flash TEST SUB MENU
========================
a.   Erase Flash
b.   Write Flash
c.   Flash ID Detect
d.   d.Display Flash
e.   Copy from Flash to Flash
ESC. Exit
========================
```

Write Flash

1. Run the 'Write Erase' menu by entering 'b' from the <Flash TEST SUB MENU>. This function erases all the data stored in the Flash memory and writes the new data.

Flash Writing task takes time because it excutes erasing and writing consecutively.

2. While the 'Write Erase' is running, the processing status is displayed in the screen as below. The <Flash TEST SUB MENU> reappears when the task is completed. If the execution fails, the address and data where the error occurs appear in the screen.

```
0          1          2          3          4          5          6
0123456789 0123456789 0123456789 0123456789 0123456789 0123456789 0123
SSSSSSSSSS SSSWWWWWWW WWWWWWWWWW WWWWWWWWWW WWWWWWWWWW WWWWWWWWWW WWWS
PASS

Flash TEST SUB MENU
============================
a.   Erase Flash
b.   Write Flash
c.   Flash ID Detect
d.   Display Flash
e.   Copy from Flash to Flash
ESC. Exit
============================
```

Flash ID Detect

1. Run the 'Flash ID Detect' menu by entering 'c' from the <Flash TEST SUB MENU>. This function displays the ID of Flash memory on board. The <Flash TEST SUB MENU> reappears when the task is completed.

2. The screen below shows an example that a Flash memory of ID 28F320 is detected.

```
Device_id is : C5
INTEL 28F320 was detected

Flash TEST SUB MENU
============================
a.   Erase Flash
b.   Write Flash
c.   Flash ID Detect
d.   Display Flash
e.   Copy from Flash to Flash
ESC. Exit
============================
```

Display Flash

1. Run the 'Display Flash' menu by entering 'd' from the < Flash TEST SUB MENU > menu. This function shows the data stored in the Flash memory.

2. Input the Start Address Offset and length of the memory in the first prompt as the example below. If the Start Address Offset is 0x0 as the example, data is displayed from the real start address of the memory, 0x400000.

```
  [Start Address Offset] [Length] : 0x0 0x100
```

3. In this example, you can see the data stored in the memory starting the address 0x400000, 0x100 long in length. The <Flash TEST SUB MENU> reappears when the task is completed.

```
[Start Address Offset] [Length] : 0x0 0x100

Success

400000    2   0  A0  E3  FD   7   0  EA  FF  FF  FF  FF   0   0  F0  3D
400010   A0  1D   0   0  F0  3D  A0  1C   0   0  F0  3D  A0  1E  31  6E
400020   38  32  20  31  31  32  39   0  FF  FF  FF  FF  FF  FF  FF  FF
400030   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
400040   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
400050   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
400060   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
400070   70  79  72  69  67  68  74  20  31  39  39  39  20  43  6F  6E
400080   65  78  61  6E  74  20  53  79  73  74  65  6D  73  2E  20  20
400090   41  6C  6C  20  52  69  67  68  74  73  20  52  65  73  65  72
4000A0   76  65  64  2E   0  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
4000B0    1  C0  59  2F  78  D4  81  10  C1  C1  C1  FF   0  10  41   0
4000C0   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
4000D0   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
4000E0   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
4000F0   FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF  FF
```

SDRAM Memory Test

1. Start the 'SDRAM Memory TEST' by entering 'b' from the <Memory TEST MEMU>. Then the <SDRAM TEST SUB MEMU> appears in the screen.

```
SDRAM TEST  SUB MENU
========================
a.   Test SDRAM
b.   Read SDRAM
c.   Write SDRAM
ESC. Exit
========================
```

2. Let us view the each of the sub menu.

Test SDRAM

Run the 'Test SDRAM' menu by entering 'a' from the <SDRAM TEST SUB MENU> menu. This function executes the SDRAM test. The <SDRAM TEST SUB MENU> reappears when the test is completed.

```
0                1                2                3
0123456789       0123456789       0123456789       01
PPPPPPPPPP       PPPPPPSSSS       SSSSSSSSSS       SS
PASS
0                1                2                3
0123456789       0123456789       0123456789       01
PPPPPPPPPP       PPPPPPSSSS       SSSSSSSSSS       SS
PASS
0                1                2                3
0123456789       0123456789       0123456789       01
PPPPPPPPPP       PPPPPPSSSS       SSSSSSSSSS       SS
PASS
0                1                2                3
0123456789       0123456789       0123456789       01
PPPPPPPPPP       PPPPPPSSSS       SSSSSSSSSS       SS
PASS

SDRAM TEST  SUB MENU
========================
a.   Test SDRAM
b.   Read SDRAM
c.   Write SDRAM
ESC. Exit
========================
```

Read SDRAM

1. Run the 'Read SDRAM' menu by entering 'b' from the <SDRAM TEST SUB MENU> menu. This function shows the data stored in the SDRAM.

2. Input the start address offset and length of the memory in the first prompt as the example below. If the Start Address Offset is 0x0 as the example, data is displayed from the real start address of the memory, 0x400000.

```
[Start Address Offset] [Length] : 0x0 0x100
```

3. In this example, you can see the data stored in the memory starting the address 0x400000, 0x100 long in length. The <SDRAM TEST SUB MENU> reappears when the task is completed.

```
[Start Address Offset] [Length] : 0x0 0x100

800000    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800010    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800020    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800030    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800040    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800050    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800060    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800070    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800080    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
800090    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8000A0    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8000B0    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8000C0    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8000D0    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8000E0    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
8000F0    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

SDRAM TEST SUB MENU
========================
a.   Test SDRAM
b.   Read SDRAM
c.   Write SDRAM
ESC. Exit
========================
```

Write SDRAM

1. Run the 'Write SDRAM' menu by entering 'c' from the <SDRAM TEST SUB MENU> menu. This function erases all the data stored in the SDRAM memory and writes the new data.

2. Input the start address offset, value to write and length of the memory in the first prompt as the example below. If the Start Address Offset is 0x0 as the example, data is displayed from the real start address of the memory, 0x400000.

```
[Start Address Offset] [Value] [Length] : 0x0 0xAA 0x100
```

3. In this example, you can see the data stored in the memory starting the address 0x400000, 0x100 long in length. When the test is completed, a message 'Writing is finished' appears and the <SDRAM TEST SUB MENU> reappears successively.

```
[Start Address Offset] [Value] [Length] : 0x0 0xAA 0x100

Writing is finished

SDRAM TEST SUB MENU
========================
a.   Test SDRAM
b.   Read SDRAM
c.   Write SDRAM
ESC. Exit
========================
```

4. To check to see if the writing process is done successfully, enter 'b' from the <SDRAM TEST SUB MENU> to run 'Read SDRAM'. The screen below is an example to run 'Read SDRAM'.

```
[Start Address Offset] [Length] : 0x0 0x100
     pMemory malloc failed in FLASHSYS!!
     @@@ malloc success

800000 AA  AA  AA  AA   AA  AA  AA  AA   AA  AA  AA  AA  AA  AA  AA  AA
800010  0   0   0   0    0   0   0   0    0   0   0   0   0   0   0   0

SDRAM TEST SUB MENU
========================
a.   Test SDRAM
b.   Read SDRAM
c.   Write SDRAM
ESC. Exit
========================
```

Ethernet Test Menu

The Ethernet TEST MENU consists of 8 menus to diagnose Ethernet port of the InfoRanger. Enter 'b' from the <START> menu to start 'Ethernet TEST MENU'. Let us find out how to use menu 'c','d','e','f', because they are used more frequently.

```
Ethernet TEST MENU
========================
a.   Tx Test
b.   Rx Test
c.   Internal Loopback Test at CPU
d.   Internal Loopback Test at MII(E-Phy)
e.   External Loopback Test at Cable
f.   MII(E-Phy) register read
g.   ReadData
h.   ReadCluster
ESC. Exit
========================
```

Internal Loopback Test at CPU

1. Entering 'c' from the <Ethernet TEST MENU> menu performs the 'Internal Loopback test at CPU'. This function tests the Loopback at CPU and has nothing to do with the external pattern of CPU.

2. If the test was successful, the following message will be displayed and the <Ethernet TEST MENU> reappears.

```
EMAC : rxd_hw calloc() success!
Ethernet LoopBack TEST PASS

Ethernet TEST MENU
========================
a.    Tx Test
b.    Rx Test
c.    Internal Loopback Test at CPU
d.    Internal Loopback Test at MII(E-Phy)
e.    External Loopback Test at Cable
f.    MII(E-Phy) register read
g.    ReadData
h.    ReadCluster
ESC.  Exit
========================
```

Internal Loopback Test at MII(E-Phy)

1. Entering 'd' from the <Ethernet TEST MENU> menu performs the 'Internal Loopback test at MII (E-Phy)'. This function tests the Loopback at the Ethernet chip and checks the status between the CPU and Ethernet chip.

2. If the test was not successful, the following 'FAIL' message will be displayed. If the test was successful, the following message will be displayed and the <Ethernet TEST MENU> reappears.

```
EMAC : rxd_hw calloc() success!
Ethernet MII LoopBack TEST PASS

Ethernet TEST MENU
========================
a.   Tx Test
b.   Rx Test
c.   Internal Loopback Test at CPU
d.   Internal Loopback Test at MII(E-Phy)
e.   External Loopback Test at Cable
f.   MII(E-Phy) register read
g.   ReadData
h.   ReadCluster
ESC. Exit
========================
```

External Loopback Test at Cable

1. Entering 'e' from the <Ethernet TEST MENU> menu performs the 'External Loopback test at Cable'. This function tests the Loopback at the InfoRanger connector, and checks the status between the CPU and the InfoRanger connector.

2. If the test was not successful, the following 'FAIL' message will be displayed. If the test was successful, the following message will be displayed and the <Ethernet TEST MENU> reappears.

```
EMAC : rxd_hw calloc() success!
Ethernet EXT LoopBack TEST PASS

Ethernet TEST MENU
========================
a.   Tx Test
b.   Rx Test
c.   Internal Loopback Test at CPU
d.   Internal Loopback Test at MII(E-Phy)
e.   External Loopback Test at Cable
f.   MII(E-Phy) register read
g.   ReadData
h.   ReadCluster
ESC. Exit
========================
```

MII(E-Phy) register read

1. Entering ‘f’ from the <Ethernet TEST MENU> menu performs the MII(E-Phy) register read. This function reads the register data in the Ethernet chip (LXT972) and shows the 32 register data.

2. If the test was successful, the following message will be displayed.

```
0     1000     7809      13     78E1     1E1       0       4    2001
8        0     FFFF    7FFF     FFFF    FFFF    7FFF    FFFF    FFFF
10      84      110       0       F4     422       0       0       0
18       0        0     1C8        0    7FFF       0       0    3278
```

Miscellaneous Test Menu

Enter ‘c’ on the <START> menu and then again enter ‘a’ to see the four LEDs of the InfoRanger blink.

Cookie Menu

Enter 'd' on the <START> menu to display the ‘Cookie function’ menu showing the information on the current cookie.
To change the values, enter the alphabet letter in front of each menu on the keyboard. After programming, press ‘S’ to save the new values.

```
cookie function

A.   BootVersionNumber             0xFFFFFFFF

B.   EMACAddress                   00 00 F0 3D A0 2E
C.   CMACAddress                   00 00 F0 3D A0 2F
D.   USBAddress                    00 00 F0 3D A0 30

E.   CMSerialNumber                1n82 1129
F.   H/W Version Major             12
G.   H/W Version Minor             01

H.   Tuner type                    TEMIC4737(3x8743)
I.   CPE Type                      ETH Only
J.   Product for                   AMERICA

K.   SDP_VHFLow                   0xC1
L.   SDP_VHFHigh                  0xC1
M.   SDP_UHF                      0xC1
N.   usUphyOffset                 0x1000
O.   usUphyGain                   0x41

S.   Save New Cookie to Flash     NOT CHANGED
ESC. Reruen to previous menu
```

Cable Downstream Test Menu

Enter ‘e’ from the <START>menu to start ‘Downstream Main Menu’.

```
Downstream Main Menu
============================
a.    Rx SNR Test
b.    Read Downstream Register
c.    SNR
ESC.  Exit
============================
```

Let us find out how to use each menu.

Rx SNR Test

1. Start the ‘Rx SNR Test’ menu by entering 'a' on the <Downstream Main Menu>.

2. When the following message appears, enter the Downstream Frequency and press [Enter] key.

```
Input Frequency :
```

The Downstream Frequency is set in Upconvertor through the Headend.

3. Next, choose a Symbol Rate between 1 (5360537) and 2 (5056941) and press [Enter].

```
5360537=1 ,5056941=2
Input Symbol Rate :
```

If the Headend Downstream is set to 256QAM, select 5360537 as a Symbol Rate. If it is set to 640QAM, select 5056941 as a Symbol Rate.

4. When the frequency and the Symbol Rate are normal, the result is displayed as in the following. The screen below shows an example that the Downstream Frequency is 855000000 and the Symbol Rate is 1 (5360537). You can also check the SNR value (ESNO).

```
5056941
DEMOD LOCKED
TRELLIS LOCKED
FEC LOCKED
MPEG LOCKED
ESNO = 310

Downstream Main Menu
============================
a.   Rx SNR Test
b.   Read Downstream Register
c.   SNR
ESC. Exit
============================
```

Read Downstream Register

Run the ‘Read Downstream Register’ menu by entering 'b' on the <Downstream Main Menu>. The data in the downstream register is displayed.

```
0      0     4C      94      40      3      0      0      0
8      0      0       0       0      1      F      0     84
10     0      0       0       0      0     12     22     80
18    10      0       9       0     42      F      E     36
20     C      0       0       0      0      0      0     80
28    2E      6      3A      4A     33     64     FF      0
30     0      0      C6       1     40     40      0      5
38     8      8       4       0      0      0      0      0
40     7     64       0       4     A4     19      8      0
48     B     65      65       0     19     4B      0     6D
50     6      2      23      FF     44      0     80     C1
58    C1      5      80      80      0     1F     40      0
60    14     46       1      ED      2      0      3      0
68     1      0       0       1      0     23      0      0
70     1      0      6F       2      0     80     D0     FE
78    FB     FF       0       0      0      0      0      0
80     F      0      80       1      0      0      0      0
88     0     80      4D       0      0      0      1      0
90     0      C      82       1      0      0      0      0
98     0      0       0       0      0      0      0      0
A0     0     8E       0       0      0      0      0      0
A8     0      0      60      75      0      0      0      0
B0    EF      0      8B      1F      0      0      0      0
B8    70      0       0       0      0      0      0      0
C0     0      0       0       0      0      0      0      0
C8     0      0       0       0      0      0      0      0
D0     0      0       0      50      3     1B      0      0
D8     0      0       0       0      0      0      0      0
E0     0      0       0       0      0      C      0     FF
E8    80      0       0       0      0

Downstream main Menu
========================
a. Rx SNR Test
b. Read Downstream Register
c. SNR
ESC. exit
========================
```

SNR

Run the ‘SNR’ menu by entering 'c' on the <Downstream Main Menu>. You can check the SNR value, which is set according the Downstream Frequency and the Symbol Rate configured in Rx SNR Test.

```
SNR =  240 dB
```

Cable Upstream Test Menu

Enter 'f' from the <START>menu to start 'Upstream Main Menu'.

```
Upstream Main Menu
==========================
a. Tx Signal
b.  Read upstream Register
c.  Tx Level Change
d.  Tx Symbol Change
ESC. Exit
==========================
```

Let us find out how to use each menu.

Tx Signal

1. Start the 'Tx Signal' menu by entering 'a' on the <Upstream Main Menu>.

2. When the following message appears, enter the upstream frequency and press [Enter]. The screen below shows an example to enter frequency 10000000.

```
Input Frequency : 10000000
```

Input the Upstream Frequency in Hz from 5 MHz to 42 MHz.

3. Second, choose a Modulation Mode between 1 (QPSK) and 2 (16QAM) and press [Enter]. The screen below shows an example to choose mode 1.

```
QPSK : 1 , 16QAM : 2
Input modulation mode : 1
QPSK mode is selected
```

4. Next, select a Symbol Rate among 160,320,640,1280,2560 and press [Enter]. The screen below shows an example to choose 160.

```
Symbol Rate '160,320,640,1280,2560'
Input Symbol Rate : 160
160 Symrate is selected
```

5. Finally, enter an Output Level and press [Enter]. The screen below shows an example to enter level 10.

```
8dBmV - 58dBmV
Input level : 10
output level is 10 dBmV
```

6. When all the parameters are entered, the result is displayed as in the following.

```
Frequency - 10000000 Hz
Output PwrLvl = 10.0 dBmv, 80 1/8 dBmV
```

7. Measure the InfoRanger signal power and check to see if the value is normal.

Read Upstream Register

Run the ‘Read Upstream Register’ menu by entering 'b' on the <Upstream Main Menu>. The data in the upstream register is displayed.

```
0     1      1      0      0      0      0      0      0
8     0      0     8B      0      0     10      0      0
10    1     FC      3      F      0      0      0      0
18   7F     52      9      0      0      0      0      0
20    0      1      0      0      0      0      0      0
28    0      0      0      0      0      0     40     40
30    C     20     50     C0      0     51     20      0
38    0      0      0      0      0      0      0      0
40    0      0      0      0      0      0

Upstream Main Menu
============================
a.   Tx Signal
b.   Read upstream Register
c.   Tx Level Change
d.   Tx Symbol Change
ESC. Exit
============================
```

Tx Level Change

Run the ‘Tx Level Change’ menu by entering 'c' on the <Upstream Main Menu>. You can change the value of Output Level entered in the ‘Tx Signal’ menu.

```
Symbol Rate '160,320,640,1280,2560'
Input Symbol Rate : 320
320 Symrate is selected

Upstream Main Menu
============================
a.   Tx Signal
b.   Read upstream Register
c.   Tx Level Change
d.   Tx Symbol Change
ESC. Exit
============================
```

Tx Symbol Change

Run the ‘Tx Symbol Change’ menu by entering 'd' on the <Upstream Main Menu>. You can change the value of Symbol Rate entered in the ‘Tx Signal’ menu.

```
Symbol Rate '160,320,640,1280,2560'
Input Symbol Rate : 320
320 Symrate is selected

Upstream Main Menu
==========================
a.   Tx Signal
b.   Read upstream Register
c.   Tx Level Change
d.   Tx Symbol Change
ESC. Exit
==========================
```

Chapter 6
Using Management Commands

Chapter 6 Using Management Commands

This chapter describes the management commands that can be used to test and debug the InfoRanger. The management commands are not required for basic InfoRanger operation.

List of Management Commands

The major management commands are listed as following.

Command	Description	See Page
macAddr	Displays the MAC address.	6-1
cmacMcast	Displays the contents of the hash filter table and the cable MAC multicast.	6-2
usb Mcast	Displays the contents of the USB multicast table.	6-2
snmpStat	Displays the statistical data of PCMAC SNMP.	6-2
showBpi	Displays the BPI Parameters.	6-3
ifShow	Displays the information of system interface.	6-4
uniShowPCMAC	Displays the unicast address table data of PCMAC.	6-5
sdf, cdf, cmSetDsFrequency	Set the downstream frequency.	6-5
showUcd	Displays the UCD information being used presently.	6-6
upStat	Displays the upstream channels.	6-8
dmdStat	Displays the physical status of downstream.	6-8
reboot	Reboot the cable modem.	6-9

macAddr

Synopsis bool macAddr()

Syntax macAddr

Description This command displays the MAC address being presently used.

Parameter N/A

Return Value 1

Example

```
→ macAddr
  MAC Address: 00:00:f0:3b:d9:9f
  value = 0 = 0x0
```

cmacMcast

Synopsis bool cmacMcast()

Syntax cmacMcast

Description This command shows the information of the cable MAC multicast table and hash filter table.

Parameter N/A

Return Value 0

Example

```
→ cmacMcast
   number of entries : 0
   Multicast Table :
   Hash Table :
   ff  ff  ff  ff
   ff  ff  ff  ff
   ff  ff  ff  ff
   ff  ff  ff  ff
   ff  ff  ff  ff
   ff  ff  ff  ff
   ff  ff  ff  ff
   ff  ff  ff  ff
   value = 0 = 0x0
```

usbMcast

Synopsis bool usbMcast()

Syntax usbMcast

Description This command shows the addresses of USB multicast table and the USB MAC.

Parameter N/A

Return Value 0

Example

```
→ usbMcast
   number of entries : 1
   Multicast Table :
   MAC Address : 01:00:5e:00:00:01
   value = 0 = 0x0
```

snmpStat

Synopsis bool snmpStat()

Syntax snmpStat

Description This command shows the upstream channel information.

Parameter N/A

Return Value 0

Example

```
→ snmpStat
   Upstream Channel Info
   Channel ID:                         2
   Channel Frequency:           34000000
   Channel Width:                3200000
```

```
Channel Mod Profile:                5
Channel Slot Size:                  2
Channel Tx Timing Offset:        8286
Channel Rng Backoff Start:          0
Channel Rng Backoff End:            4
Channel Tx Backoff Start:           0
Channel Tx Backoff End:             4

MAC Entry Get
T3 Rng Resp Timeout:         10000000

CM Status
Lost Syncs:                         0
Invalid Maps:                       0

CM Services
Service ID:                      1353
Qos Profile:                        5
Tx Slot Immed:                      0
Tx Slots Ded:                    5406
Tx Retries:                        27
Tx Exceededs:                       0
Rq Retries:                         1
Rq Exceededs:                       0
value = 0 = 0x0
```

showBpi

Synopsis void showBpi ()

Syntax showBpi

Description This command shows the BPI Parameter information.

Parameter N/A

Return Value N/A

Example

```
-> showBpi
   ------------------------------------------------------------
                  RSA Modulus Keysize  : 1024
                   BPI Operating Mode  : BPI 1.0 Mode
              Upstream Encryption Mode  : Encrypted

                     AuthWait Timeout  : 10
                   ReAuthWait Timeout  : 10
              Authorization Gracetime  : 60
             Operational Wait Timeout  : 5
                   Rekey Wait Timeout  : 5
                 Maximum Clock Offset  : 60
         Authorize Reject Wait Timeout  : 60
                   SA Map Wait Timeout  : 1
                    SA Map Max Retries  : 4

                 Active TEKS list: 0x0549(1353)
   ------------------------------------------------------------
                    value = 61 = 0x3d = '='
```

ifShow

Synopsis void ifShow ()

Syntax ifShow

Description This command shows the system interface information.

Parameter N/A

Return Value N/A

Example

```
→ ifShow
   mac (unit number 1):
       Flags: (0x8063) UP BROADCAST MULTICAST ARP RUNNING
       Type: ETHERNET_CSMACD
       Internet address: 10.10.11.36
       Broadcast address: 10.10.11.255
       Netmask 0xff000000 Subnetmask 0xffffff00
       Ethernet address is 00:00:f0:3b:d9:9f
       Metric is 0
       Maximum Transfer Unit size is 1500
       294 packets received; 226 packets sent
       116 multicast packets received
       0 multicast packets sent
       0 input errors; 0 output errors
       0 collisions; 0 dropped
   lo  (unit number 0):
       Flags: (0x8069) UP LOOPBACK MULTICAST ARP RUNNING
       Type: SOFTWARE_LOOPBACK
       Internet address: 127.0.0.1
       Netmask 0xff000000 Subnetmask 0xff000000
       Metric is 0
       Maximum Transfer Unit size is 32768
       52 packets received; 52 packets sent
       0 multicast packets received
       0 multicast packets sent
       0 input errors; 0 output errors
       0 collisions; 0 dropped
   mac (unit number 2):
       Flags: (0x8063) UP BROADCAST MULTICAST ARP RUNNING
       Type: ETHERNET_CSMACD
       Internet address: 192.168.100.2
       Broadcast address: 192.168.100.255
       Netmask 0xffffff00 Subnetmask 0xffffff00
       Ethernet address is 00:00:f0:3b:d9:a0
       Metric is 0
       Maximum Transfer Unit size is 1500
       0 packets received; 1 packets sent
       0 multicast packets received
       0 multicast packets sent
       0 input errors; 0 output errors
       0 collisions; 0 dropped
   mac (unit number 0):
       Flags: (0x8063) UP BROADCAST MULTICAST ARP RUNNING
       Type: ETHERNET_CSMACD
       Internet address: 192.168.100.1
       Broadcast address: 192.168.100.255
       Netmask 0xffffff00 Subnetmask 0xffffff00
```

uniShowPCMAC

Synopsis void uniShowPCMAC ()

Syntax uniShowPCMAC

Description This command shows the unicast adress table data of PCMAC.

Parameter N/A

Return Value N/A

Example

```
→ uniShowPCMAC
   Entry Number [Enabled]      MAC Address
   Addr # 0 [1]:             00:00:f0:3b:d9:9f
   Addr # 1 [1]:             00:d0:b7:73:12:8b
   Addr # 2 [0]:             00:00:00:00:00:00
   Addr # 3 [0]:             00:00:00:00:00:00
   Addr # 4 [0]:             00:00:00:00:00:00
   Addr # 5 [0]:             00:00:00:00:00:00
   Addr # 6 [0]:             00:00:00:00:00:00
   Addr # 7 [0]:             00:00:00:00:00:00
   Addr # 8 [0]:             00:00:00:00:00:00
   Addr # 9 [0]:             00:00:00:00:00:00
   Addr #10 [0]:             00:00:00:00:00:00
   Addr #11 [0]:             00:00:00:00:00:00
   Addr #12 [0]:             00:00:00:00:00:00
   Addr #13 [0]:             00:00:00:00:00:00
   Addr #14 [0]:             00:00:00:00:00:00
   Addr #15 [0]:             00:00:00:00:00:00
value = 0 = 0x0
```

sdf

Synopsis void sdf(UINT32 f)

Syntax sdf f

Description Set the downstream frequency.

Parameter f is a new downstream frequency.

Return Value N/A

Example

```
→ sdf  555000000
```

cdf , cmSetDsFrequency

Synopsis void cdf (UINT32 f) or void cmSetDsFrequency (UINT32 f)

Syntax cdf f or cmSetDsFrequency f

Description Set the Downstream frequency and does not reset the InfoRanger.

Parameter f is a new downstream frequency.

Return Value N/A

Example

```
cdf  555000000
cmSetDsFrequency  555000000
```

showUcd

Synopsis void showUcd()

Syntax showUcd

Description This command shows the information of CM UCD sent from CMTS.

Parameter N/A

Return Value N/A

Example

```
→ showUcd
   Available UCIDs : 1  2
   Current Upstream Channel Parameters
     ID                          2
     Downstream ID               1
     Power                       51 1/4dbmv
     Frequency                   34000000 Hz
     Change Count                34
     Request Size                2 mini-slots
     Mini Slot Size Exponent     1
     Symbol Rate                 2560 ksym/sec
     Preamble Len                1024 bits
     Preamble Pattern :
      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33
      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33
      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33
      33 33 b0 b0 cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf
      cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf
      cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf
      cf cf cf cf cc ef cc ef
   IUC type(1) :          REQUEST                      VALID : 1
     Modulation                QPSK
     Differential Encoding     OFF
     Active Preamble Length    64 bits
     Preamble Offset Value     440 bit
     FEC (T)                   OFF
     FEC Codeword Len          NOT USED
     Scrambler Seed            338
     Max Burst Size            2 mini-slots
     Max Burst Size            6 bytes
     Max Guard Time Size       7 Symbol times
     Last Codeword Length      FIXED
     Scrambler                 ON
     Bytes/mini-slot           8
   IUC type(2) :          REQ / DATA Multicast          VALID : 0
     Modulation                UNKNOWN
     Differential Encoding     UNKNOWN
     Active Preamble Length    45271 bits
     Preamble Offset Value     44264 bit
     FEC (T)                   194 bytes
     FEC Codeword Len          61 bytes
     Scrambler Seed            33559
     Max Burst Size            141 mini-slots
     Max Burst Size            28321 bytes
     Max Guard Time Size       200 Symbol times
     Last Codeword Length      UNKNOWN
     Scrambler                 UNKNOWN
     Bytes/mini-slot           40945
```

```
IUC type(3) :          INITIAL MAINTENANCE            VALID : 1
  Modulation                  QPSK
  Differential Encoding       OFF
  Active Preamble Length      128 bits
  Preamble Offset Value       384 bit
  FEC (T)                     5 bytes
  FEC Codeword Len            34 bytes
  Scrambler Seed              338
  Max Burst Size              0 mini-slots
  Max Burst Size              0 bytes
  Max Guard Time Size         47 Symbol times
  Last Codeword Length        FIXED
  Scrambler                   ON
  Bytes/mini-slot             8
IUC type(4) :          STATION MAINTENANCE            VALID : 1
  Modulation                  QPSK
  Differential Encoding       OFF
  Active Preamble Length      128 bits
  Preamble Offset Value       384 bit
  FEC (T)                     5 bytes
  FEC Codeword Len            34 bytes
  Scrambler Seed              338
  Max Burst Size              0 mini-slots
  Max Burst Size              0 bytes
  Max Guard Time Size         47 Symbol times
  Last Codeword Length        FIXED
  Scrambler                   ON
  Bytes/mini-slot             8
IUC type(5) :          SHORT DATA GRANT               VALID : 1
  Modulation                  16QAM
  Differential Encoding       OFF
  Active Preamble Length      144 bits
  Preamble Offset Value       864 bit
  FEC (T)                     5 bytes
  FEC Codeword Len            78 bytes
  Scrambler Seed              338
  Max Burst Size              8 mini-slots
  Max Burst Size              78 bytes
  Max Guard Time Size         7 Symbol times
  Last Codeword Length        SHORTENED
  Scrambler                   ON
  Bytes/mini-slot             16
IUC type(6) :          LONG DATA GRANT                VALID : 1
  Modulation                  16QAM
  Differential Encoding       OFF
  Active Preamble Length      160 bits
  Preamble Offset Value       848 bit
  FEC (T)                     10 bytes
  FEC Codeword Len            235 bytes
  Scrambler Seed              338
  Max Burst Size              0 mini-slots
  Max Burst Size              0 bytes
  Max Guard Time Size         7 Symbol times
  Last Codeword Length        SHORTENED
  Scrambler                   ON
  Bytes/mini-slot             16
value = 31 = 0x1f
```

upStat

Synopsis: void upStat ()

Syntax: upStat

Description: This command shows the upstream channel information.

Parameter: N/A

Return Value: N/A

Example

```
→ upStat
   Available UCIDs : 1  2
   Current Upstream Channel Parameters
     ID                          2
     Downstream ID               1
     Power                       51 1/4dbmv
     Frequency                   34000000 Hz
     Change Count                34
     Request Size                2 mini-slots
     Mini Slot Size Exponent     1
     Symbol Rate                 2560 ksym/sec
     Preamble Len                1024 bits
     Preamble Pattern :
      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33
      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33
      33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33
      33 33 b0 b0 cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf
      cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf
      cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf cf
      cf cf cf cf cc ef cc ef
   value = 1 = 0x1
```

dmdStat

Synopsis: void dmdStat ()

Syntax: dmdStat

Description: This command shows the physical status of downstream

Parameter: N/A

Return Value: N/A

Example

```
→ dmdStat
   Frequency          : 555000000
   QAM Mode           : 256
   Interleave Depth   : 32
   Spec Inversion     : No
   Es/No * 10         : 345
   RSOutOfSyncCount   : 0
   value = 20 = 0x14
```

reboot

Synopsis	void reboot ()
Syntax	reboot
Description	This command reboots the cable modem.
Parameter	N/A
Return Value	N/A
Example	→ reboot

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Chapter 7
Structure of the InfoRanger

Chapter 7 Structure of the InfoRanger

Introduction

InfoRanger is a user terminal within Cable Modem System that consists of ISP (Internet Service Provider), Internet network, Headend, HFC network, InfoRanger, and PC, which receives ISP-provided Internet service through Headend into PC to display (figure 7-1). InfoRanger also send signals to Headend (upstream), so a two-way communication takes place between Headend and InfoRanger.

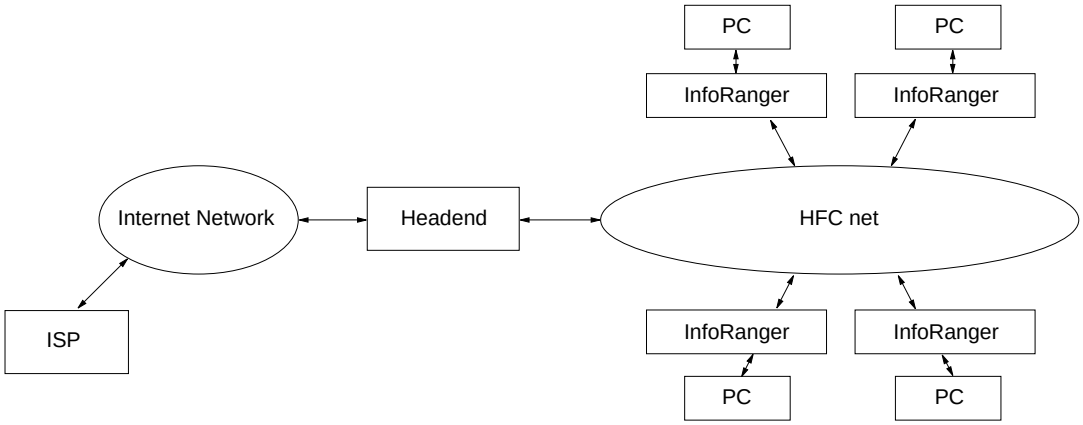


Figure 7-1 Cable Modem System

While the existing phone line modem uses baseband phone line (Up to 30 KHz), InfoRanger, by using broadband HFC network (Up to 1 GHz), realizes high data transmission rate (Up to 40 Mbps for download, up to 5 Mbps for upload).

InfoRanger consists of cable interface, microprocessor memory, Ethernet interface and circuits. This chapter explains the signal streams sent to each part and the roles of each element.

Cable Interface

Introduction

First, let's have a brief look at the signal methods of downstream (receiving signal) and upstream (sending signal).

Downstream (Receiving Signal)

1. RF signal: The Input downstream signal into InfoRanger is QAM converted (64-QAM / 256-QAM) RF signal whose Center Frequency is between 90 and 858MHz and its bandwidth 6 MHz.

2. IF signal: This RF signal is inputted through F-connector of tuner, then down converted in the tuner to be IF signal whose center frequency of 43.75MHz and bandwidth of 6 MHz.

3. Secondary amplification: After going through SAW (Surface Acoustic Wave) filter, the converted IF signal is authorized for uPC2798 with the built- in Down Converter / AGC Amp to be amplified to become center frequency of 43.75MHz and bandwidth of 6 MHz.

4. Authorized as CN9414 IC: The amplified secondary IF signal, after going through DS filter, is inputted to CN9414 IC with the built-in 64 / 256 QAM receiver.

Upstream (Sending Signal)

1. Data Occurrence: Upstream digital data occurred in the microprocessor inside the CN9414 is converted to QPSK / 16-QAM analog signal with center frequency of 5 ~42 MHz and bandwidth of 200K ~3.2 MHz.

2. Signal Conversion: The converted signal, after going through BPF in 5 M ~ 42 MHz, is inputted as programmable power amp MAX3510.

3. Output for Cable: First the input signal is output with appropriate power level in MAX3510. Second, it goes through BPF. Finally, it is output for the cable through the F-connector of the tuner.

The following displays briefly the signal streams in the cable interface part.

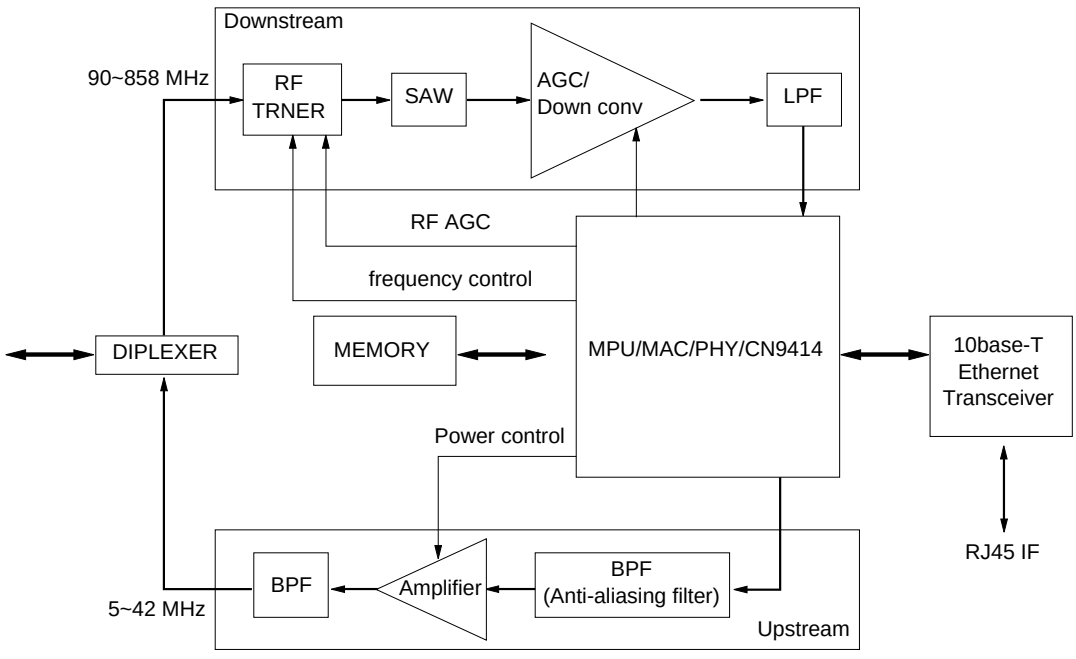


Figure 7-2 Cable Interface Part Block Diagram

Downstream

Tuner (4737PY5)

IF Signal Conversion

In order to convert input RF signal with center frequency of fc (90<fc<860MHz) into IF signal with center frequency of43.75MHz, I2C Bus Line (Data, Clock) is put into SDA (#10), SCL (#9) terminals in the tuner from RF_SDA (#C5), RF_SCL (#A5) terminals of CN9414, respectively. CN9414 has the tuning frequency information.

The following is the timing diagram of I2C Bus interface.

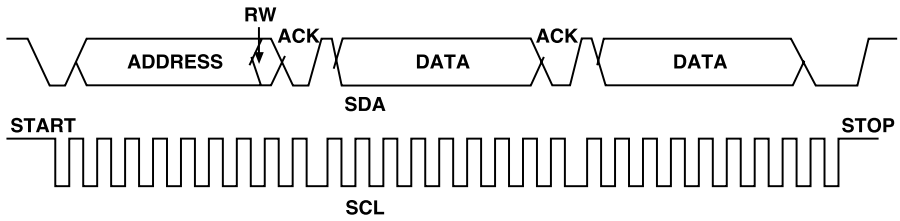


Figure 7-3 Tuner Control Signal Timing diagram

Also, control signal on tuner AGC comes out of AGC_RF (#D3) of CN9414 to be converted into a 3.6V DC value in a circuit composed of R124, C147, R422, C407 and U404. Then, the converted signal is put into AGC (#5) of the tuner. Here, the control signal is a PWM (Pulse Width Modulation) signal and the larger the Duty Cycle, the bigger the DC value that the control signal is converted into.

DC-DC Converter

Composed of U802 (TK11819), L807, L808, C821, C822, C823, C824 and R809, DC-DC converter generates 33V DC for the tuner from 5V power. The voltage is put into 33V (#7) terminal of the tuner.

Down converter/AGC Amp (uPC2798)

IF signal input

IF signal that is put out through IF_OUT (#12, #13) terminals of the tuner, after going through SAW filter (X6964M100) and built-in R414, R415, C411, C412 and R401 for Impedance Matching, is authorized for AGC_IN1, AGC_IN2 (#1, #2) terminals in Down-Converter / AGC Amp (uPC2798).
Here, the IF signal is sent in Differential Mode along the two lines in order to reduce the effect of the Common Mode Noise in each line.

IF Signal Amplification

Input IF signal is amplified through AGC Amp within uPC2798. Then, the control signal that comes out of AGC_IF(#C2) terminal in CN9414 goes through LPF composed of R123, C162, R402, C413, R403, and R404 to be filtered as DC value and finally be put into VAGC (#3) terminal in uPC2798 for controlling the degree of amplification.

IF Signal Output

The secondary IF signal identical to the first IF signal is filtered through LPF composed of C418, R407, C419, L403, L404, L405, C421, C422, C423, and L407, and again goes through the amplifier within the IC before it is put out through OUT1, OUT2 (#12, #11) terminals of uPC2798. The output secondary IF signal is put into +IF_OUT, -IF_OUT (#H1, #G1) terminals of CN9414 through R412, R413, C429, C431 and C430.

DC-DC Converter

DC-DC converter, composed of U403, C434, and C435, generates 9V DC for AGC amplification inside uPC2798 from 12V power. The generated power is put into VCC2(#13) terminal of uPC2798.

100MHz Clock

100 MHz(120MHz) clock needed in CN9414 is generated in Crystal (Y101), C102, C103, C104 and L101, and then put into XTI,XTO (#J1,#K1) terminals.

Dual AGC Operatrions

As shown in the Fig. 2 (Downstream Block Picture), the downstream circuit composed of tuner (4737PY5), SAW filter (X6964M), down converter / AGC Amp (uPC2798), Cable MAC / PHY (CN9414) is in dual AGC loop.

Measuring AGC Control Voltage (AGC (#5), uPC2798 VAGC (#3) of the tuner) according to input signal level reveals that the tuner AGC works as critical control signal for stronger input signals while uPC2798 AGC works as major control signal for weaker ones. Therefore, for the entire input signal level, a linear AGC control is in the works through Dual AGC Operations.

	64-QAM		256-QAM	
Input Signal Level (dBmV)	Tuner AGC Input Voltage (Volt)	uPC2798 AGC Input Voltage (Volt)	Tuner AGC Input Voltage (Volt)	uPC2798 AGC Input Voltage (Volt)
+20	1.52	1.18	1.53	1.18
+15	1.65	1.18	1.72	1.18
+10	2.06	1.18	2.08	1.18
+5	2.53	1.18	2.55	1.18
0	2.71	1.18	2.71	1.18
-5	2.94	1.18	2.93	1.18
-10	3.65	1.19	3.61	1.18
-15	3.65	1.32	3.65	1.31
-20	3.65	1.40	3.65	1.39

Table 7-1 AGC Control Voltage Chnges according to Input Signal Level

Upstream

As shown in Figure 7-2, upstream is composed of Cable MAC / PHY (CN9414), OP Amp Driver (MAX3510) and other peripheral circuits.

BPF(Anti-alias Filter)

The output Analog converted upstream signal through +TX_IN, -TX_IN (#T1, #R1) terminals of CN9414, goes in the Differential Mode. It goes through BPF that passes signals in 5~42MHz only.
Composed of C807, L803, C808, R804, R805, R806, R807, C804, C805, L801, L802, L804 and L805, BPF filters out the Harmonics and the signal noise from CN9414.

Power Amp (MAX3510)

The three signals (TXASEL, TX_SDA,TX_SCL) for controlling upstream power is transmitted from CN9414 IC to MAX3510 IC. How the three signals are combined determines the level satisfying DOCSIS SPEC between 8dBmV and 58dBmV.

1. **Input** : Upstream signal comes out of CN9414 to go through the first BPF is put into +VIN (#5), -VIN (#6) terminals of MAX3510.
2. **Output** : Input signal goes through PGA (Programmable-Gain Amplifier) inside the ARA05050 and is put out of +VOUT (#16), -VOUT (#15) terminals. Output signal from +VOUT, -VOUT terminals is processed impedance matching as 300ohm and becomes Single-ended signal with impedance matching of 75ohm as it goes through the transformer (T801) with voltage ratio of 2 to 1.

Cable MAC/PHY (CN9414)

CN9414 is an integrated IC of four features: 64 / 256 QAM receiver with downstream PHY function, QPSK / 16 QAM Transmitter with upstream PHY function, Cable MAC and microprocessor.

64/256 QAM Receiver

Downstream signal in Differential Mode that is put into +IF_OUT, -IF_OUT (#H1, #G1) terminals of CN9414 first goes through the following steps.

1. amplified by PGA(Programmable Gain Amplifier)
2. converted to digital by 10-Bit A / D converter
3. demodulated as digital data after going through QAM Demodulator

First, digital signal processes such as phase recovery and adaptive equalizer are done on the demodulated digital data. Then, as it goes through FEC (Forward Error Correction) such as Trellis, Decoding, Deinterleaving, and Reed-Solomon decoding, it is converted into the original Serial digital data with errors corrected. The corrected data is finally sent to cable MAC.

16 QAM/QPSK Transmitter

Upstream data that has been through Cable MAC of CN9414 is sent to the upstream transmitter part. The transmitted data will in for channel coding such as Randomizing, Reed-Solomon encoding to recover the errors generated during the transmission. And then, it is converted into digital QAM data by the processes such as Pre-Equalizing, Pulse Shaping, Interpolation, and QAM modulation.

The modulated data is converted into analog data by D / A converter inside the CN9414 to be put out through +TX_IN, -TX_IN (#T1, #R1) terminals in the Differential Mode.

Cable MAC

This is where MAC algorithm is realized to enable multiple users to communicate in the cable network. This extracts MAC frame from downstream data to store in SRAM and transmits it to the transmitter part of an authorized time slot after the upstream data stored in SRAM is made as MAC frame.

Microprocessor and Momory Interface

Microprocessor and memory interface part consists of a memory device, Ethernet and a microprocessor (CN9414) that controls the entire operation by Operation Code. See the following diagram.

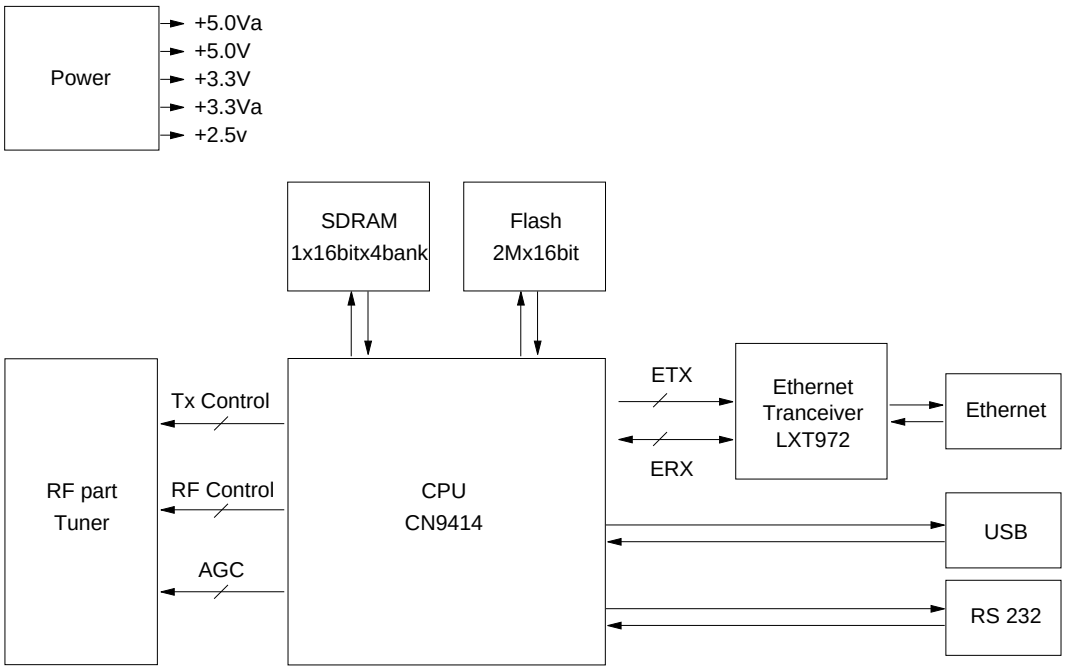


Figure 7-4 SCM120R Board Block Diagram (CN9414 solution)

Microprocessor(CN9414)

Configuration

There are two 32 Bit RISC processors in CN9414. As shown in Figure 7-5, the processor consists of memory related modules and peripheral modules.
The following is a brief description of critical modules to the circuit and their function.

- The Two 32-bit RISC microprocessors operating in100MHz, 120MHz internal clock, respectively. (35.84MHz for external clock)
- SRAM internal memory
- Timer, Clock pulse generator (Watchdog timer, Interrupt)
- Host interface for external memory access (Address decoding, Wait state generation)
- SDRAM Interface (RAS, CAS signals)
- DMA Controller
- Ethernet PHY
- Cable MAC
- Cable PHY
- Serial Interface (UART)

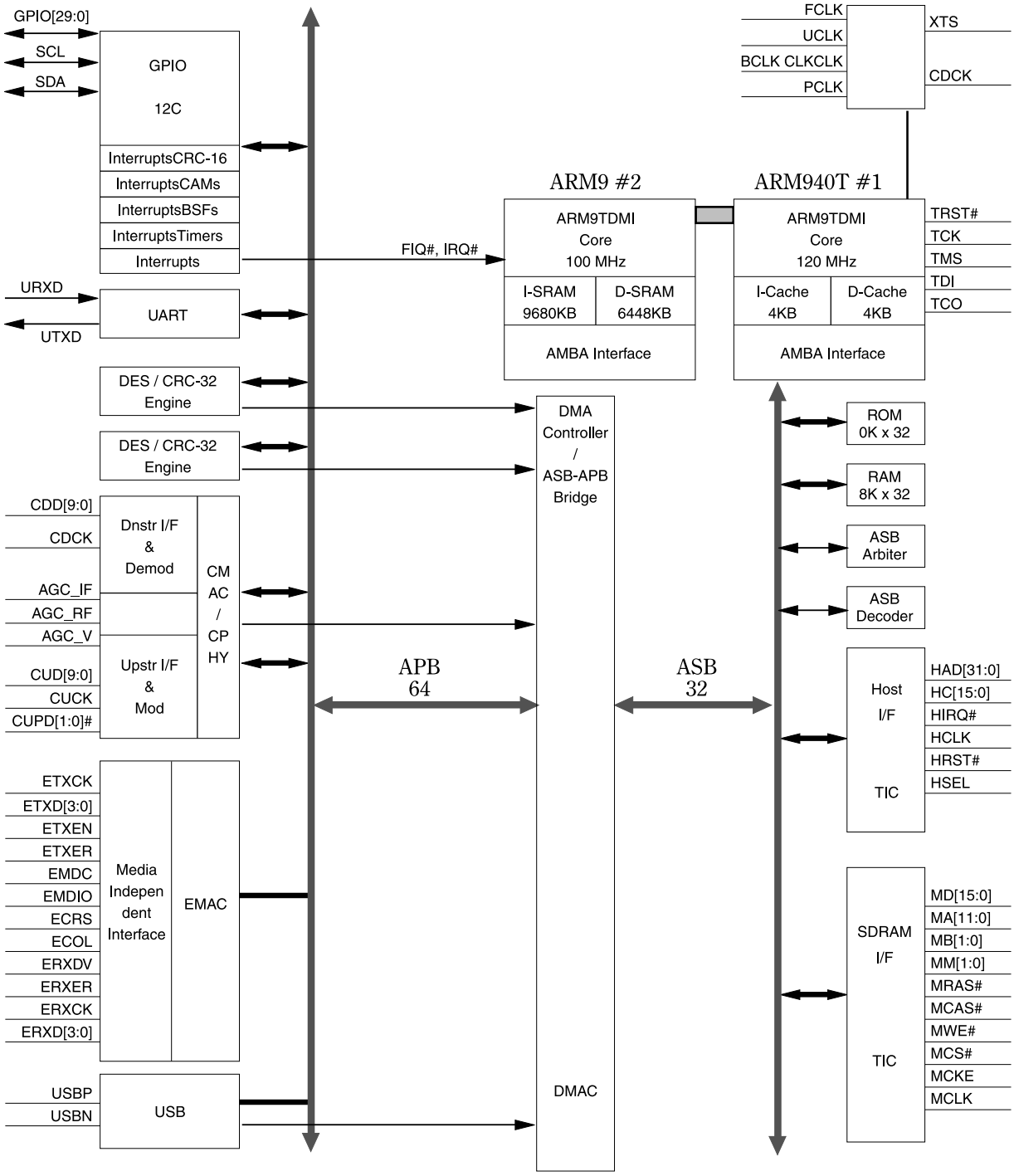


Figure 7-5 CN9414 Block Diagram

Interrupt

ARM has two interrupts FIQ and IRQ. FIQ interrupt has a higher priority over IRQ interrupt. In the circuit, there is no interrupt generated by external hardware.
Apart from FIQ and IRQ, there are two additional internal interrupts as follows.

- Software watchdog and other timers (internal interrupt)
- UART (internal interrupt)

Host Interface

ARM, with built-in host interface, manages external memory access. CN9414 has a direct access to eight flash memories and other memory devices using host interface controller. The memories used through the host interface of InfoRanger are flash ones.

Flash memories are allocated for CS0 (HCS0) and the interface can be set as either 8 bit or 16bit. The interface range is determined by HSEL Pin (W10) in CPU. For InfoRanger that its HSEL pin is set as "Low", the interface is 16bit. CN9414 is connectable for up to 4Mbyte.

Though rarely the case currently, InfoRanger can use PROM, NVRAM or peripheral elements in proper parts.

The following table shows the source and Chip Select Signal available for CN9414.

AREA	ADDRESS	DEVICE	DATA WIDTH	USE
0	0x0040_0000 0x007F_FFFF	Flash memory($Mbyte)	16bit	/ HCS[0]
1	0x0020_0000 0x0023_FFFF	256Kbyte	space	/ HCS[1]
2	0x0024_0000 0x0027_FFFF	256Kbyte	space	/ HCS[2]
3	0x0028_0000 0x0028_FFFF	64Kbyte	space	/ HCS[3]
4	0x0029_0000 0x0029_FFFF	64Kbyte	space	/ HCS[4]
5	0x002A_0000 0x002A_FFFF	64Kbyte	space	/ HCS[5]
6	0x002B_0000 0x002B_FFFF	64Kbyte	space	/ HCS[6]
7	0x002C_0000 0x002C_FFFF	64Kbyte	space	/ HCS[7]
8	0x002D_0000 0x002F_FFFF	192Kbyte		Reserved for ASB Registers

Table 7-2 Memory Map

SDRAM Controller

There is an XMAC (eXpansion Memory Acess Controller) inside ARM, which works as SDRM for up to 8Mbyte SDARM and 16bit interface. Here, SDRAM is driven as 100MHz.
The available SDRAM configuration is following:

Total Memory	Memory Configuration	# SDRAMs	SDRAM Configuration	SDRAM Capacity	SDRAM # Banks	SDRAM # Rows	SDRAM # Cols
2MB	1M x 16	1	1M x 16	16Mb	2	2K	256
4MB	2M x 16	2	2M x 8	16Mb	2	2K	512
8MB	4M x 16	1	4M x 16	64Mb	4	4K	256

Table 7-3 SDARM Configuration

Internal Memory and Memory MAP

There are Internal memory (SRAM) and Register inside ARM, and their address allocation is as follows.

AREA	ADDRESS	DEVICE	DATA WIDTH	USE	Descriptions
1	0x0000 0000 0x0000 001F	ROM / FLASH	32	Read Only Memory	ARM #1 Vector table
	0x0000 0020 0x000F FFFF		32		ROM / FLASH
2	0x0010 0000 0x0010 001F	24K*32 SRAM(AIM)	32		ARM #2 Vector table (Internal)
	0x0010 0020 0x0011 FFFF		32		ARM #2 Instruction Memory (Internal)
3	0x0014 0000 0x0014 FFFF	16K*32 SRAM(ADM)	32		ARM #2 Data Memory (Internal)
4	0x0018 0000 0x0018 7FFF	8K*32 SRAM	32		ASB SRAM(Internal)
5	0x0020 0000 0x0023 FFFF	EPROM(256Kbyte)	space	/ HCS[1]	Host Mast-mode Peripherals I / F
	0x0024 0000 0x0027 FFFF	EPROM(256Kbyte)	space	/ HCS[2]	
	0x0028 0000 0x0028 FFFF	64Kbyte	space	/ HCS[3]	
	0x0029 0000 0x0029 FFFF	64Kbyte	space	/ HCS[4]	
	0x002A 0000 0x002A FFFF	64Kbyte	space	/ HCS[5]	
	0x002B 0000 0x002B FFFF	64Kbyte	space	/ HCS[6]	
	0x002C 0000 0x002C FFFF	64Kbyte	space	/ HCS[7]	
	0x002D 0000 0x002F FFFF	192Kbyte	64	Reserved for ASB Registers	
6	0x0030 0000 0x0030 0070		32bit	Reserved for internal DMA Controller Registers	APB Bridge dword access only
	0x0031 0000 0x0031 0023		32bit	Reserved for internal Cable MAC Registers	
	0x0032 0000 0x0032 0023		64, 32, 16	Reserved for internal Ethernet MAC Registers	
	0x0033 0000 0x0033 0023		64, 32, 16	Reserved for internal USB Registers	
	0x0034 0000 0x0034 0028		8.32bit	Reserved for internal DES#1	
	0x0036 0000 0x0036 0007		32bit	Reserved as Cable PHY Register Interface	
	0x0035 0010 0x0037 000c			Reserved for internal Miscellaneous Registers	
	0x0038 0000 0x0038 0028		8.32bit	Reserved for internal DES#2	

AREA	ADDRESS	DEVICE	DATA WIDTH	USE	Descriptions
7	0x0040_0000 0x007F_FFFF		16bit	/ HCS[0]	Host Master mode Flash Interface
8	0x0080 0000 0x00FF FFFF			SDRAM	External DRAM Interface

Table 7-4 Memory MAP

Clock Pulse Generator

InfoRanger requires Clock Sources, which are set as follows.

- CPU : 35.8MHz or 46.8MHz crystal (for CN9414)- determined by the pin A10 in CPU.
  - H : 46.8MHz
  - L : 35.8MHz
- Ethernet tranceiver : 25 MHz (from CPU (all pins) Ethernet tranceiver (pin 1))
- SDRAM (KM416S4030CT-F8) : 100 MHz (from CPU (pin M18) SDRAM (pin 38))
- USB : 60MHz
- Upstream : 143.36MHz
- Downstream : 45.84MHz

Clock		Reference Source	Reference Freq(MHz)	Typ Freq(MHz)	PLL Frequency Oper	Output frequency	Description
XFCK	FCLK	Crystal	45.84MHz	120MHz	Fout=Fx*M.N	Programmable	ARM940T fast clock in
	UCLK		45.84MHz	60MHz	Fout/2		USB timing reference
XBCK	BCLK	Crystal	45.84MHz	100MHz	Fout=Fx*M.N	Programmable	ASB Bus Clock
	PCLK		45.84MHz	50MHz	Fout/2		APB Bus Clock
CUCK		Crystal	45.84MHz	143.36MHz	Fout=4*Fs		Cable Upstream D/A Clk
CDUK		Crystal	45.84MHz	35.84MHz	N/A		Cable Downstream Clock
EPCLK		BCLK	100MHz	25MHz	N/A		Ethernet Phy Clock

Table 7-5 Clock Sources

PLL

CPU has three built-in PLLs. One is used for the analog part while other two are for digital.

- Analog PLL : when PLL is used for analog, four-fold frequency of the input (crystal) frequency is in use.
- Digital PLL : the two remaining PLLs used for digital are adjusted as program through the internal register. The InfoRanger part is used as 120MHz and 100MHz.

CPU Pin E1

CPU Pin E1 (PLLtst) is used to determine at hardware level whether to bypass PLL part in CPU. When the pin is in ‘H’, PLL part is bypassed and then pin TBUCK (pin M1) is used to drive the analog part.

The function can be controlled at software level using a software bit, BYPASS_PLL. When controlling at software, set PLLtst and TBUCK as 'L'.

CPU Pin B10

When CPU pin B10 (XPB) is in ‘H’, PLL is bypassed, so XFCK(pin C10) and XBCK are used as input. When the pin is in ‘L’, XFCK (pin C10), XBCK are used as output.

CPU Pin A11

CPU pin A11(XBCK) is used as system clock input in PLL mode while it is used as Ethernet mast clock out put in normal mode.

Cable Media Access Controller Interface

CN9414 has Cable MAC, Cable PHY and others. Cable PHY is divided into downstream and upstream.

- Downstream: Downstream sends signal that is modulated and encoded in Headend equipment. The modulated signal is sent to cable MAC after it is demodulated and decoded in the user cable modem.
- Upstream: Upstream modulates and encodes signal to send to cable Headend equipment.

Downstream part is composed of as follows.

- A / D Converter
- Demodulator
- Forward Error correction
  - Trellis Decoder
  - Differential Decoder
  - FEC Frame Synchronizer
  - Derandomizer
  - Deinterleaver
  - Reed-Solomon Decoder Error Detection
  - MPEG Transport Packet Synchronizer
- Clock smoother

Upstream part is composed of as follows.

- Modulator
  - Preamble
  - Reed-Solomon Encoder
  - Scrambler, Bit-to-symbol Mapper
  - Differential Encoder
  - FIR and interpolation filters, Barrel shifter, and Quadrature Modulator
- Amplifier Control Supporter

Ethernet MAC

Since Conexant CPU CN9414 has built-in EMAC (Ethernet Media Access controller), it sends and receives data by externally connecting to MII (Media Independent Interface).
EMAC makes both 10/100M MII-compatible Ethernet device mode and 7-wire HomeLan device mode programmable.

PIN	Ethernet Mode	HomeLAN Mode
ETXCK	Tx clock	Tx clock
ETXEN	Tx enable	Tx enable
ETXD[0,1,2,3]	bit 0 of 4 bit parallel Tx data	Serial Tx data
ECOL	Collision	Collision
ECRS	Carrial	Carrial
ERXCK	Rx clock	Rx clock
ERXD[0,1,2,3]	bit 0 of 4 bit parallel Rx data	Serial Rx data

Table 7-6 Media Independent Interface Signal

Flash Memory(AMD29DL323D, Intel28F320)

InfoRanger uses one flash memory with 4Mbyte capacity. The memory consists of 16Bit data bus (HAD0 ~ HAD15) and 21 Bit address bus (HC1~HC7, HAD16 ~ HAD29).

The size of flash memory must be no larger than 4Mbyte in CN9414.

Memory Part

4MByte flash memory largely consists of three parts.

1. First 1Mbyte : Bootrom Image
2. The next 1Mbyte : Working Image 1
3. The final 1Mbyte : Working Image2

Memory Access

Read Access Time of Flash Memory is 100ns. Access time is defined by setting HST_WST (0x002D004) register inside the microprocessor. Holding Time is set in the register HST_XFER_CNTL (0x002D008).

Reading and Writing

Flash memory access is selected by HC [0] (pin Y17), HC [8] (pin V12) and HC [9] (pin Y11) of the microprocessor and address. The addresses allocated for flash memory are from 0x400000 to 0x7FFFFF. You can both read and write on Flash memory. The major control signals for the memory are HC [0] pin Y17), HC [8] (pin V12), and HC [9] (pin Y11). These signals all operate as Active Low.

1. When writing, Chip Enable signal (HC [0]) and Write enable (HC [9]) operate as Active “Low”.
2. When reading, Chip Enable signal (HC [0]) and Output enable (HC [9]) operate as Active “Low”

The following pictures Figure 7-6 and Figure 7-7 show Flash Read and Write Timing, respectively.

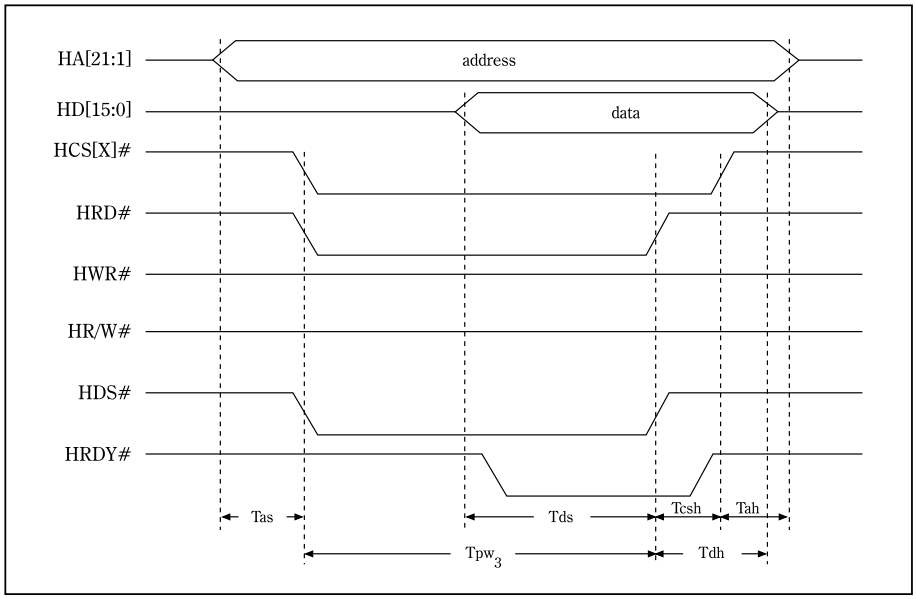


Figure 7-6 Flash Memory Read Timing

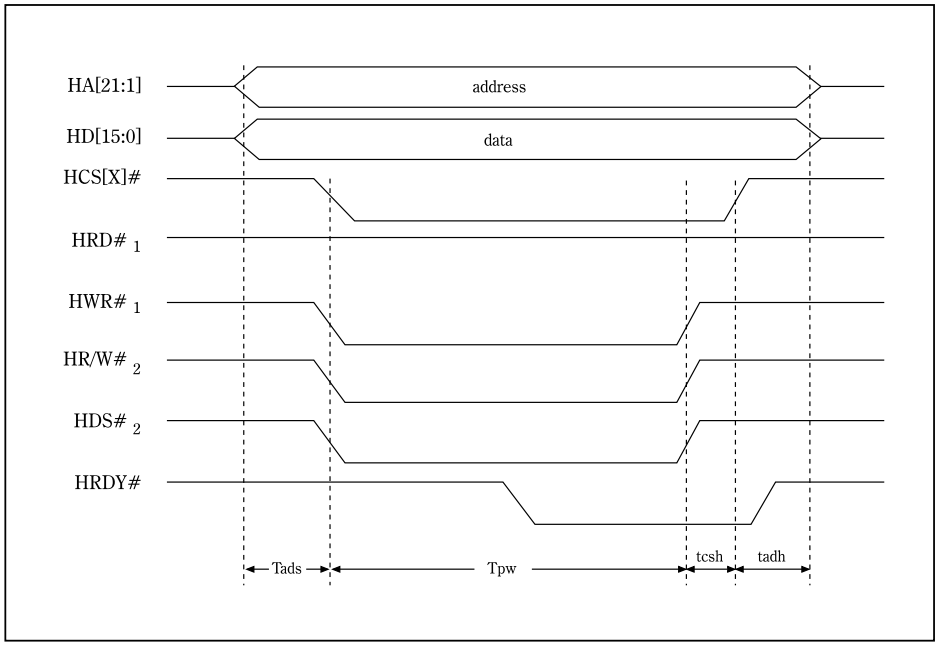


Figure 7-7 Flash Memory Write Timing

SDRAM(K4S641632D)

DRAM

SDRAM is in use for InfoRanger. The memory consists of 16 Bit Data bus (D0 ~ D15) and 12 Bit Address bus (A0 ~ A11). The access time for DRAM is 80ns. Control signal for DRAM consists of RAS (#18), CAS (#17), WE (#16) and CS (#19).

SDRAM

SDRAM memory access is driven by RAS signal generated in MRAS (#G18) of microprocessor and CAS signal generated in MCAS (#H19).

SDRAM memory address consists of 11 Bit (row) and 8 Bit (column). When RAS is Low addresses in the rows are valid and when CAS is Low addresses in columns are valid. The final address is determined by the combination of row and the column addresses.

Reading and Wrinting

- When reading, the equipment is selected by Chip Select (Low) signal generated in microprocessor _MCS (G19) terminal while the data is read by the addresses composed of RAS and CAS, and the signal (High) generated in microprocessor _MWE (#L18) terminal.
- When writing, the equipment is selected by Chip Select (Low) signal generated in microprocessor _MCS (G19) terminal while the data is written by the addresses composed of RAS and CAS, and the signal (High) generated in microprocessor _MWE (#L18) terminal.

The compressed image stored in flash memory is decompressed in SDRAM when the power is provided. The image consists of operation code, Configuration Parameter and Data Buffer.

User Interface

Ethernet Tranceiver (LXT 972)

Sending and Receicing Signals

- Sending signal : Ethernet tranceiver interfaces the CPU and Ethernet line. When sending signal, it Menchester encodes digital data to convert into analog data for output.
- Receiving signal : When receiving signal, it demodulates analog data into digital signal and Menchester decodes to send to the processor.

Register

Ethernet tranceiver has 32 internal registers. When the power is provided, these registers are set as default value and can be also set by users through CPU.
Register setting data is transmitted by MDIO (#42) while the clock is sent by MDC (#43).

Clock and Loopback

LXT972 supports 10 / 100Mbps Full-duplex and operates as 3.3V. Power consumption is about300mW.

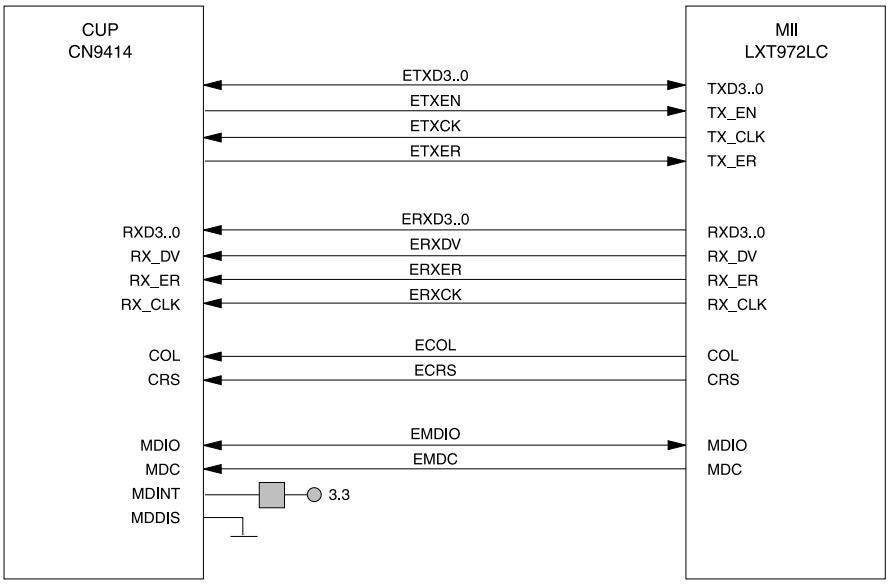
1) External clock requirements
External clock sources (25 MHz for100 Mbps, 2.5MHz for 10Mbps) or crystal

2) MDIO clock requirements
MII management channel (MDIO) uses external clock of up to 8MHz.

3) Loopback

- operational loopback
  ; 10Mbps half duplex support (register 16 , 8bit = 0)
- test loopback
  ; 100TX, 10TX support (register 0, 14bit = 1
  register 0, 8bit = 1
  register 0, 12bit = 0)

The following is a brief block diagram of Ethernet tranceiver and CPU.



Ethernet Line Interface

Ethernet Line interface part is composed of a transformer and several passive elements.

Others

Power

InfoRanger uses 12 V DC power adapter and the power is provided through power jack (P501).
The power voltage in use for board is 5Va, 5V, 3,3Va, 3.3V, and 2.5V. Internally DC-DC converter is used for each voltage.

Display

InfoRanger has four LEDs (LED601, LED602, LED603, LED604) each of which is controlled by CPU GPIO port. The content for each is POWER_LED, RECEIVE_OK_LED, SEND_OK_LED, and PC_LED.

Switch

Reset Switch

InfoRanger has MAX708S, a Voltage Monitoring Supervisor. When power is authorized, MAX708S _MR (#1) terminal maintains 3.3V. However if you press and release S101, a circuit connected to Ground from +3.3_VCC through R219 is set and _MR terminal generates pulse that drops to 0V and surges back to 3.3V. MAX708S detects the pulse and sends Falling Pulse to microprocessor _HRST (#W4).
Pulse drop and surge as hardware reset signal reboots InfoRanger.

Connectors

F-connector(withinTU401)

Downstream and upstream signals are sent and received through this cable port. .

Ethernet connector (P301)

During communicating with PC, the connector Ethernet sends and receives Ethernet packets.

Power Jack (P501)

The 12V DC power is input through this connector from power adapter.

JTAG Port(U601)

JTAG port is used for loading data into flash memory through Multi-ICE.

RS-232C Port (P602)

RS-232C port is used for communication, when InfoRanger is being debugged in connection with Console. Here, RS-232C cable is required as well as Console Jig board that changes the signal level between the InfoRanger and Console. (3.3V Volt ↔ +10/-10 Volt)

Chapter 8
Network Component

Chapter 8 Network Component

This technical note describes the network components required to support DOCSIS-compliant cable modems. The provisioning model is as described in "Operations Support System Interface Specification (OSSI)". Some terminology has been modified in the interest of brevity, but the essential model is the same.

The DOCSIS series of specifications defines an IP-only network service using an HFC cable plant as the primary interface for residential Internet access through personal computers. Other protocols such as NETBEUI and AppleTalk are supported if encapsulated in TCP/IP or bridged through IP tunnels.

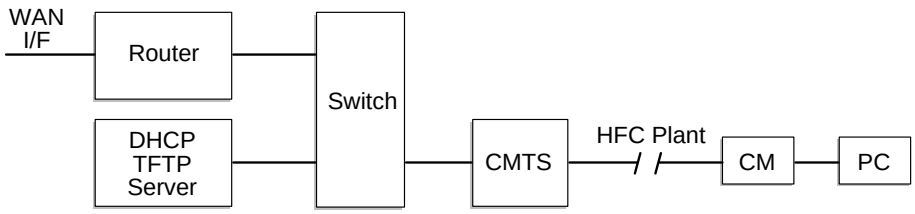
Although telephony return modems are supported, only two-way modems are described in this document.

Provisioning Model

It is useful to split the provisioning model into network-side components and plant-side components. The network-side components consist of element management layers and higher level OSS's support basic business processes such as billing, IP-address allocation, and network monitoring. These components are not described in this document.

The plant-side components consist minimally of:

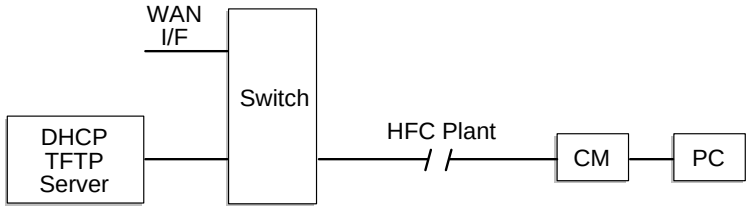
- InfoRanger
- HFC Plant and RF Termination Equipment
- Cable Modem Termination System (CMTS)
- Switch
- DHCP/TFTP Server
- Router



The cable modems may be any DOCSIS 1.0 / 1.1 compliant cable modems running on a HFC plant which has passed both analog certification and digital certification. In the United States analog certification is an annual measurement procedure mandated by the Federal Communications Commission (FCC). Assuming that the plant also passes a yet to be defined digital certification process, it can be assumed that CMTS-InfoRanger link has measurable reliability.

While the InfoRanger is currently defined as a bridge device, the CMTS may be either a bridge or a router. If the CMTS is a router, then some multiple service operators (MSOs) may choose to simplify the hub equipment scheme to eliminate the extra router and switch.

In this configuration, the CMTS is configured as a proxy, forwarding DHCP requests from the InfoRanger to the DHCP server.



In addition in areas where DOCSIS modems have low penetration, the DHCP/TFTP server may be located somewhere on the wide-area network (WAN). The purpose of the DHCP/TFTP server is store and provide the cable modem's online configuration. An outline of the InfoRanger's initialization procedure is as follows:

1. DHCP Protocol obtains boot parameters includes IP address, subnet mask, servers (TOD and TFTP) addresses, and configuration file name.
2. Time Protocol obtains local time from an RFC-868 time server specified in the DHCP vendor option area.
3. TFTP protocol downloads configuration file specified by DHCP.
4. Decode and authenticate the configuration file.
5. (Optional) TFTP protocol downloads new software image specified by the configuration file (only if running image is older).
6. Send REG-REQ link message to CMTS. The message uses the class of service profile found in the configuration file.
7. Receive REG-RSP link message from CMTS containing modem's service IDs (SIDs).
8. Negotiate link encryption for each baseline privacy enabled SID. Includes multicast SIDs with ISP specific content.

Cable Modem Configuration File

DOCSIS cable modems perform an automatic registration process to establish a link with the network. As part of this process, DHCP is used to grant the cable modem an IP address but also to tell the cable modem the IP address of a TFTP server from which it MUST download a configuration file. The configuration file format is defined in DOCSIS RFI specification.

An example class of service is:

```
Class ID                              1
Maximum Downstream Rate               2048000
Maximum Upstream Rate                 128000
Upstream Channel Priority             7
Guaranteed Minimum Upstream Rate      0
Maximum Upstream Transmit Burst       0
Class of Service Privacy Enable       0
```

The resulting file in hex is:

```
03 01 01 04 1F 01 01 01 02 04 00 1F 40 00 03 04
00 01 F4 00 04 01 07 05 04 00 00 00 00 06 02 00
32 07 01 00 06 10 BF BF 6F AF 5C 23 6D 00 AF 67
12 80 20 4C DC E0 07 10 F3 8C 9B D5 7E 60 33 07
6C E5 0D 0D 53 12 5C 6D FF 00
```

DHCP Server Configuration

In addition to the standard IP address fields, the DHCP server should be configured to provide the following fields specified by RFI specification.

The name of the InfoRanger configuration file is specified in the 128 bytes boot file name field - not by any parameter in the vendor options area. Here is an example config for ISC-DHCP version 1.0.

```
subnet 19.6.14.16 netmask 255.255.255.240 {
range 19.6.14.18 19.6.14.30;
default-lease-time 600;
max-lease-time 7200;
option subnet-mask 255.255.255.240;
option routers 19.6.14.17;
option time-servers 19.6.14.1;
option time-offset -28800;
option option-128 13:06:0e:01;
}
group {
filename “/tftpboot/bronze.cm”;
host cm173 { hardware ethernet 00:e0:1e:b2:bb:d7; }
}
```

The security server IP address, option 128, may need to be configured as a custom option. Not many DHCP currently support this option. In the above example, the IP address is specified in hexadecimal. The DHCP server should be accessible by CMTS via an interface other than the cable interface being served.

In addition to serving cable modems, the DHCP server must be flexible enough to also serve host PCs behind the modems. IP addresses should be segregated into groups. One group for PCs, the other for modems. Modems IP address assignment should be keyed on MAC address. This provides administrative control of the service class assignment for each subscriber. Generally, static IP assignment is used to allow SNMP-based network management.

Host IP address assignment may be dynamic or static based on ISP service parameters. Currently, modem and host IP addresses are members of the same subnet. This restriction will not apply in the future CMTS software releases.

TFTP Server

Currently, a standard TFTP server should be accessible by CMTS via an interface other the cable interface being served. The cable modem configuration files must be kept in the filename path specified by the DHCP server. Multiple configuration files specifying different classes of service may be used to serve a community of modems. It is not necessary to store one file per modem.

Web Server

If the TFTP server host also supports a WEB server, then the configuration file editor may be installed. This allows configuration files to be edited using a Java applet. Please see an accompanying document for installation instructions.

CMTS Configuration

Specifically, a Cisco's headend system the uBR7246, functions as a router type CMTS. Therefore, IP addresses must be defined for each running interface. The cable interface must have a statically assigned IP address which is a member of the subnet for the modems and hosts reached over the RF interface.

In addition, the "ip helper-address" command should be set to the IP address of the DHCP server. Multiple DHCP servers may be specified. Currently, both modems and PCs should be served by the same server. If multiple DHCP servers are used, they must be able to coordinate assigning IP addresses in the same subnet.

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Chapter 9
Network Layer Properties

Chapter 9 Network Layer Properties

Protocol Stack

The main function of the InfoRanger is to act as an 802.1d-compliant transparent bridge. Transparent bridging refers to the fact that the operation and presence of these devices in an IP network is transparent or invisible to the network (IP) layer. Bridges perform operations based on Ethernet/802.3 MAC addresses. The protocol stack provides 802.1d-compliant transparent bridging and conforms to MCNS specifications. The protocol stack does not perform source route bridging.

The InfoRanger must also function as an LLC host and as an IP host. That is, in addition to performing bridging functions, the InfoRanger must also act as a termination point for Ethernet/802.3MAC frames and/or IP packets and, therefore, must have both a unique Ethernet/802.3 MAC address for its Cable interface and an IP address.

The table below shows the protocol stack components.

<table>
<tr><th>SNMP</th><th>TFTP</th><th>DHCP</th><th>Security Mgmt</th></tr>
<tr><td colspan="4">UDP</td></tr>
<tr><td colspan="4">IP, ICMP, ARP</td></tr>
<tr><td>Ethernet/802.2 LLC</td><td rowspan="4" colspan="2">802.1d Transparent Bridging</td><td rowspan="2">Ethernet/802.2 LLC</td></tr>
<tr><td>Link Security</td></tr>
<tr><td>Cable MAC</td><td>Ethernet/802.3 MAC</td></tr>
<tr><td>Cable PHY</td><td>802.3 10Base-T</td></tr>
</table>

The InfoRanger SNMP agent supports the dot1dBase and dot1dTp MIB groups described in RFC1493, Bridge MIB.

Features	Description
Cable MAC Control/ Baseline Privacy	Establishes communication and baseline security with the CMTS, establishes IP connectivity with the assistance of the DHCP and TFTP clients, and manages Cable MAC control messages received via SNMP.
Cable Driver	Provides the interface to the Cable MAC hardware.
Ethernet Driver	Provides the interface to the Ethernet MAC hardware.
Bridging (SCM-120R)	Provides 802.1d-compliant Transparent Bridging between the Ethernet and Cable drivers.
USB Driver (SCM-120U)	Provides the interface to the USB MAC hardware.
Bridging (SCM-120U)	Provides 802.1d-compliant Transparent Bridging between the Cable driver and Ethernet/USB.
DHCP Client	Acquires configuration data via the Dynamic Host Configuration Protocol from a DHCP server at the headend to establish IP connectivity and to identify location of InfoRanger configuration file. The DHCP server “leases” configuration data to the client for a duration established by the DHCP server administrator.
TFTP Client	Acquires a InfoRanger configuration data file via the Trivial File Transfer Protocol. The Cable Mac Control/Baseline Privacy functional unit provides the TFTP server and file name specified in the configuration data acquired by the DHCP client.

Features	Description
SNMP Agent	Provides remote access to the InfoRanger 's Cable Mac Driver and Cable MAC Control, TCP & UDP/IP, and bridging parameters via the Simple Network Management Protocol. From hosts equipped with SNMP client software at the Headend, network administrators can "get" or "set" the parameters defined the following Management Information Bases (MIBs) supported by the InfoRanger : • MIB II (defined in RFC1213) • Cable MIB (defined in the Internet draft) • Bridge MIB (defined in RFC1493)

Cable Driver

The Cable Driver provides the interface to the cable MAC hardware.

Ethernet Driver

The Ethernet driver provides the interface to the Ethernet MAC hardware.

USB Driver (InfoRanger SCM-120U)

The USB driver provides the interface to the USB MAC hardware.

Bridging

802.1d Transparent Bridging is supported. The optional Spanning Tree Protocol is not supported by this version of the InfoRanger. The InfoRanger must include the ability to filter and disregard 802.1d BPDUs. This is the default mode of operation in this release. Any BPDUs received on the LAN interface or on the cable interface are ignored.

The InfoRanger bridges the following Ethernet/802.3 MAC frames received at its cable interface to the LAN interface:

Unicast frames containing IP packets with destination MAC address of a host device on the InfoRanger LAN interface. If the destination MAC address is that of the InfoRanger itself, the frame is processed by higher layer software on the InfoRanger .

Note that bridging of frames to the LAN interface only for devices known (i.e. learned) to be on that interface is a deviation from 802.1d bridging which specifies that frames with unknown (i.e not yet learned) destination MAC address are to be transmitted to all interfaces save for the interface on which they were received.
Since [SP-RFI] does not include InfoRanger -specific, Cable MAC addressing for frames encapsulating IP packets (data PDUs), the InfoRanger must take one of two approaches for receiving such frames.

The InfoRanger will only receive data from the cable interface with destination MAC addresses of hosts known by the InfoRanger to be on its LAN interface or destination MAC address of the InfoRanger itself. This is the preferred method for the InfoRanger and proceeds as follows:

- On start-up, InfoRanger programs the cable MAC hardware to initially receive only frames with destination MAC address of the InfoRanger itself,
- After system initialization, InfoRanger learns of LAN topology as per 802.1d. As MAC addresses of hosts on LAN side are learned, the InfoRanger programs the cable MAC hardware to receive frames containing those MAC addresses. Those addresses are also stored in an address cache so that the InfoRanger can ignore local traffic between hosts on the LAN side.

The InfoRanger, therefore, receives no data other than that destined for the InfoRanger itself until it has learned of the existence of one or more hosts on its LAN interface. Therefore, All unicast frames containing IP packets received by the InfoRanger on its cable interface and not intended for the InfoRanger itself are bridged to the LAN interface.

- Broadcast frames containing IP packets.
- Multicast frames containing IP packets.

Some multicast considerations:

- The InfoRanger could snoop in ICMP packets to determine which multicast groups are joined by hosts on its LAN interface and then program the cable MAC hardware to receive only multicast frames corresponding to those groups.
- The InfoRanger could take no involvement and simply receive and bridge all multicast frames to the LAN interface. This will not support the baseline privacy encryption of multicast sessions.

All other MAC frames received at the Cable interface are ignored.

The InfoRanger bridges the following Ethernet/802.3 MAC frames received at its LAN interface to the headend:

Unicast frames containing IP packets unless

The destination MAC address is that of a host device on the InfoRanger LAN interface. The InfoRanger discovers which devices are on its LAN interface through Transparent Bridge learning. In this case the frame is dropped.

The destination MAC address is that of the InfoRanger itself. In this case the frame is processed by higher layer software on the InfoRanger.

The fact that the InfoRanger has only three interfaces allows for another modification to 802.1d: there is no need for the InfoRanger to learn of the network topology on the cable side. Learning the cable side topology and maintaining a potentially large cache of MAC addresses of devices learned to be on the cable side is a pointless exercise. If such a cache were maintained the steps for bridging a frame received at the LAN interface would be as follows:

- If destination MAC address is that of InfoRanger, pass the frame to higher layer software.
- If destination MAC address exists in cable side address cache, forward frame to cable interface forward frame to cable interface by unknown destination address rule

Clearly, the net result of having a cable side address cache or not is identical.

- Broadcast frames containing IP packets.
- Multicast frames containing IP packets.

All other MAC frames received at the LAN interface are ignored.

The Bridging functional unit communicates with the following functional units:

- Cable Driver for Tx and Rx of data frames.
- Ethernet Driver for Tx and Rx of data frames.
- UDP/IP for Rx of data frames destined for InfoRanger, Tx of data frames originating at InfoRanger
- USB Driver (SCM-120U) for Tx and Rx of data frames.

TCP and UDP/IP

This functional unit provides standard IP, TCP, and UDP layers. The SNMP, TFTP, and DHCP functional units require only the UDP and IP layers. ARP and ICMP are generally considered to be part of the IP protocol.

Downstream (CMTS → InfoRanger) ARP requests are handled in the following way:

- ARP requests for InfoRanger physical address are answered with cable interface 802 MAC address.
- All other ARP requests are bridged to Ethernet interface. In case of using the USB port of InfoRanger SCM-120U, the requests are bridged to USB interface.

Upstream (Host → InfoRanger) ARP requests are handled in the following way:

- ARP requests for InfoRanger physical address are answered with Ethernet interface 802 MAC address. In case of using the USB port of InfoRanger SCM-120U, the requests are answered with USB interface 802 MAC address.
- All other ARP requests are bridged to the cable interface.

Downstream (CMTS → InfoRanger) ICMP messages are handled in the following way:

- Echo Requests (ping) addressed to InfoRanger are answered on cable interface with Echo Reply.
- Echo Requests addressed to other than InfoRanger are bridged to Ethernet interface. In case of using the USB port of InfoRanger SCM-120U, the echo requests are bridged to USB interface.
- Other ICMP requests addressed to InfoRanger TBD.
- Other ICMP requests addressed to other than InfoRanger are bridged to Ethernet interface.

Upstream (Host → InfoRanger) ICMP messages are handled in the following way:

- Echo Requests (ping) addressed to InfoRanger are answered on Ethernet interface with Echo Reply. In case of using the USB port of InfoRanger SCM-120U, the echo requests are answered with USB interface with Echo Reply.
- Echo Requests addressed to other than InfoRanger are bridged to cable interface.
- Other ICMP requests addressed to InfoRanger TBD.
- Other ICMP requests addressed to other than InfoRanger are bridged to cable interface.

DHCP

The DHCP functional unit is responsible for implementing the Dynamic Host Configuration Protocol which is used by the InfoRanger to obtain its IP address at system initialization.

The InfoRanger DHCP client handles the first stage of configuration, acquiring parameters for basic IP configuration such as IP address and subnet mask, and the location of a InfoRanger configuration file that it can download via Trivial File Transfer Protocol (TFTP).

TFTP

The TFTP functional unit is responsible for implementing the Trivial File Transfer Protocol which is used by the InfoRanger for the following:

- To download an optional parameters file at system initialization.
- To download a new software image in response to an SNMP command.

SNMP

The InfoRanger software supports SNMPv1 as defined in RFC 1157, SNMPv2 and MIB-II as defined in RFC 1907, RFC2011, RFC2013 and so on, although not all MIB objects will be supported in this release.

The InfoRanger software also supports the dot1dBase and dot1dTp (transparent bridging) MIB groups of the Bridge MIB defined in RFC 1493. The InfoRanger software also supports the MIB defined in RFC2670 and the Internet draft (draft-ietf-ipcdn-mcns-bpi-mib-00.txt), a proposed alternative to the MCNS cable MIB defined in "Operations Support System Interface Specification" for cable system specific management objects.

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Appendix A
Troubleshooting

Appendix A Troubleshooting

Troubleshooting in Physical Layer

In this section, overall troubleshooting method in physical layer is provided which can be utilized when there occur trouble with InfoRanger on the site or on the service line. First section shows simple treatments which can be taken on the site without opening cases. Remaining sections describe technical troubleshooting methods which are possible with aid of several instruments in the lab. In this process, reference to 'Chapter 5 Using the Diagnostics Program' is highly recommended.

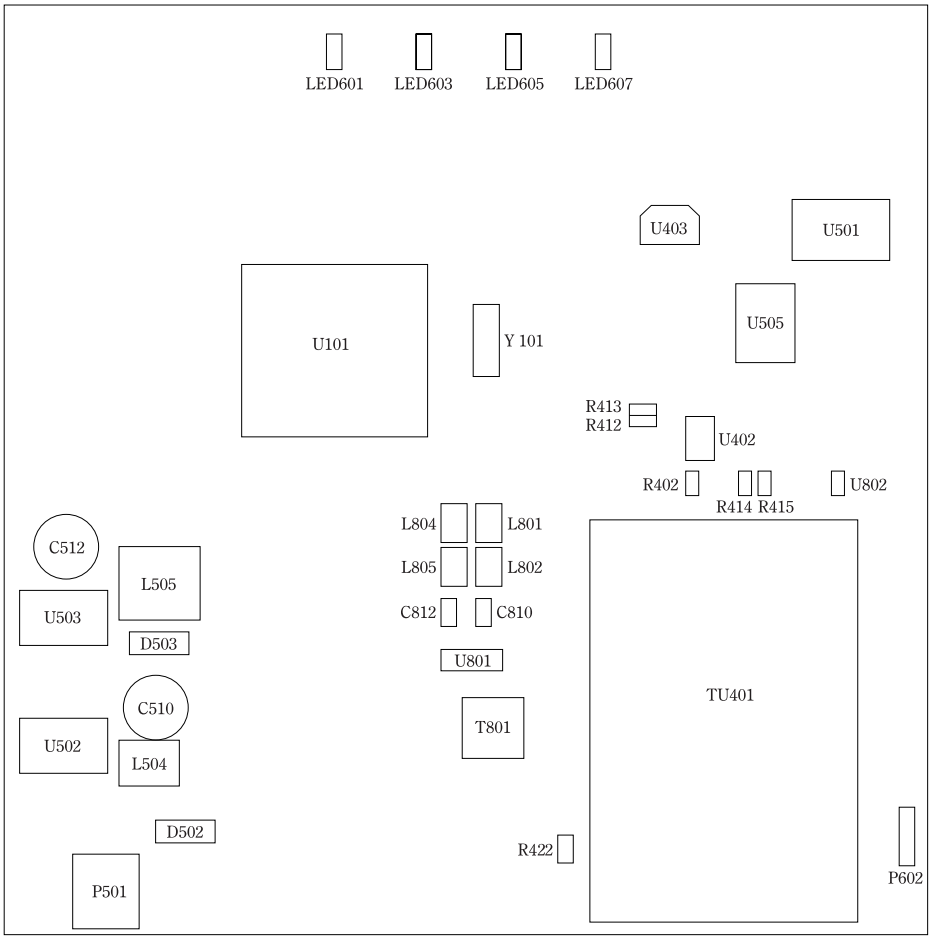
Instruments Needed

The following instruments are required for troubleshooting the InfoRanger.

Item	Model No.	Maker
CATV Analyzer	HP8591C	HP
QAM Modulator	BCM93133	Broadcom
Up Converter	C6U	GI
Step Attenuator	VSSA-42	Viewsonics
Power Splitter	Any 3dB Power Splitter	
Digital Volt Meter	Any Digital Volt Meter	
Oscilloscope	Any oscilloscope with 100MHz	
PC	Any PC with OS higher than Windows 95 and Hyper Terminal	
Console Jig Board	Provided for service purpose	Samsung
DC Power Supply	Any DC Power Supply	
Server	Any PC with Windows NT	
CMTS	Any DOCSIS-compliant CMTS	
Fixed Attenuator	Any Fixed Attenuator with 10dB x 3	
Diplexer Filter	VSREDP-40	Viewsonics

Location of Test Points

Locations test points on the PCB(top view) are shown for quick identification in the following figure. They are marked as Hxx.



On-site Check

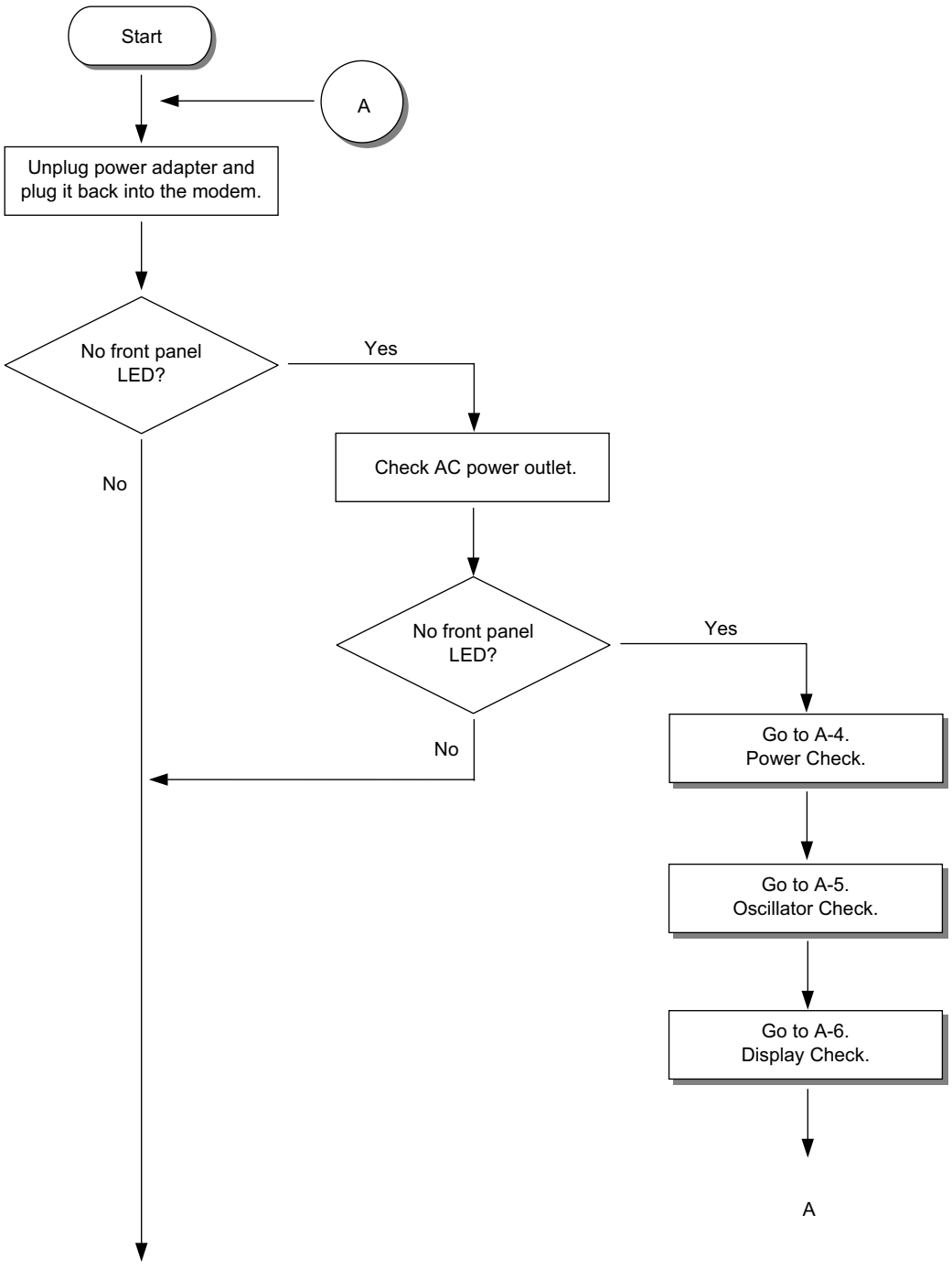
Purpose

To provide quick remedy mainly by checking connections and to identify symptoms for further checking. The cases shall not be open in this process. The process described in bold box shall be done in the lab.

Required Instrument

Portable CATV Analyzer (optional)

TS Flow Chart



Power Check

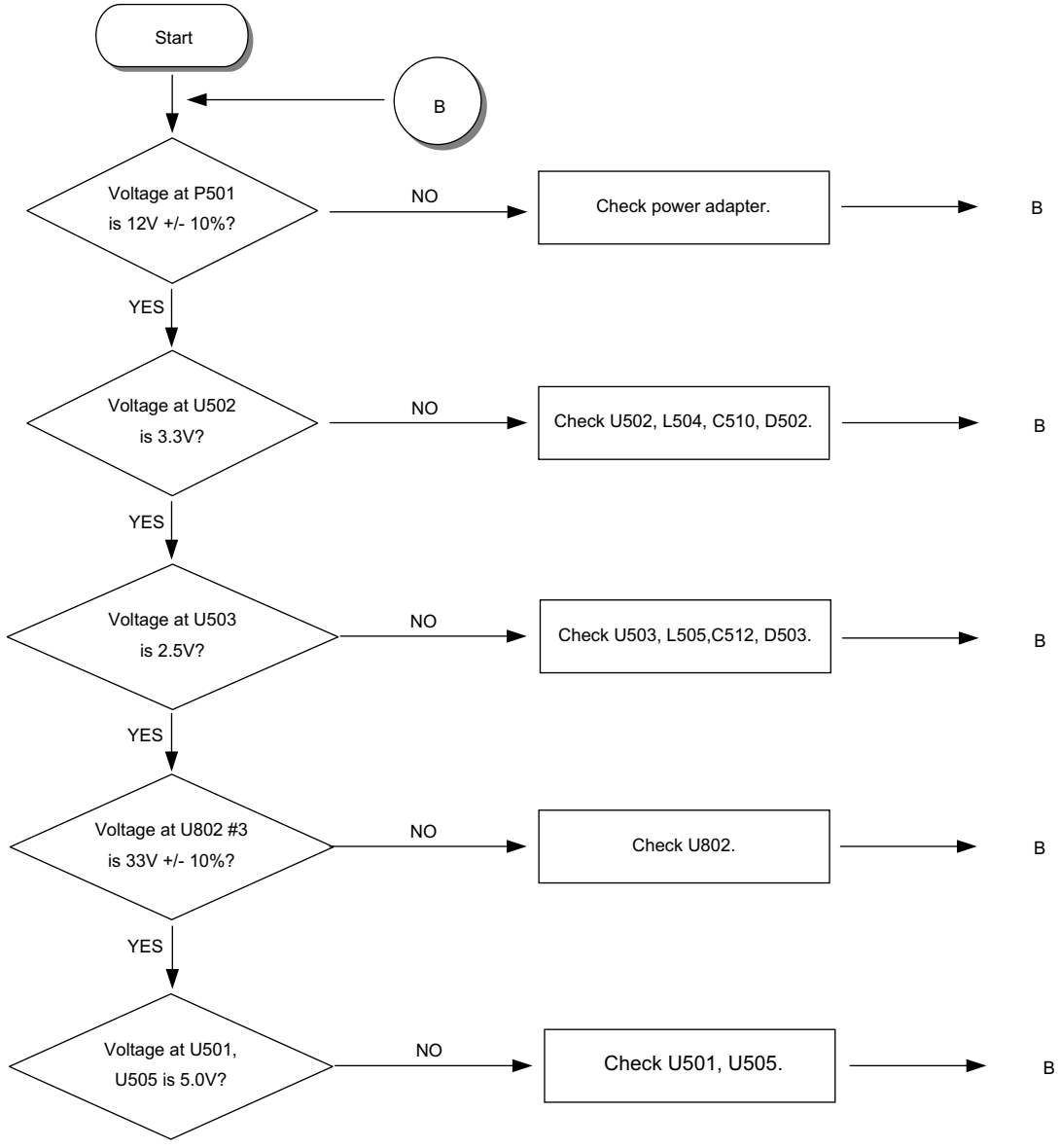
Purpose

To check DC power voltages 12V, 3.3V, 2.5V, 33V and 5V.

Required Instrument

DVM or oscilloscope

TS Flow Chart



Oscillator Check

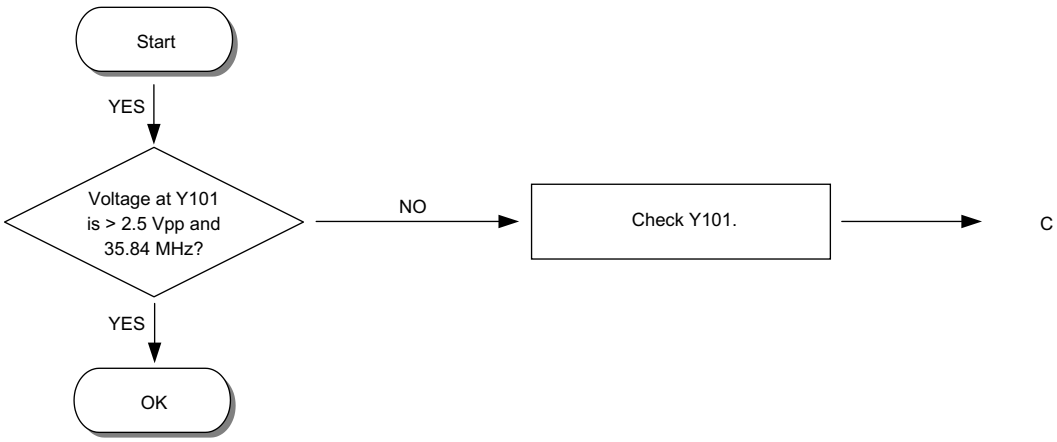
Purpose

To check oscillator waveforms (35.84MHz)

Required Instrument

Oscilloscope

TS Flow Chart



Display Check

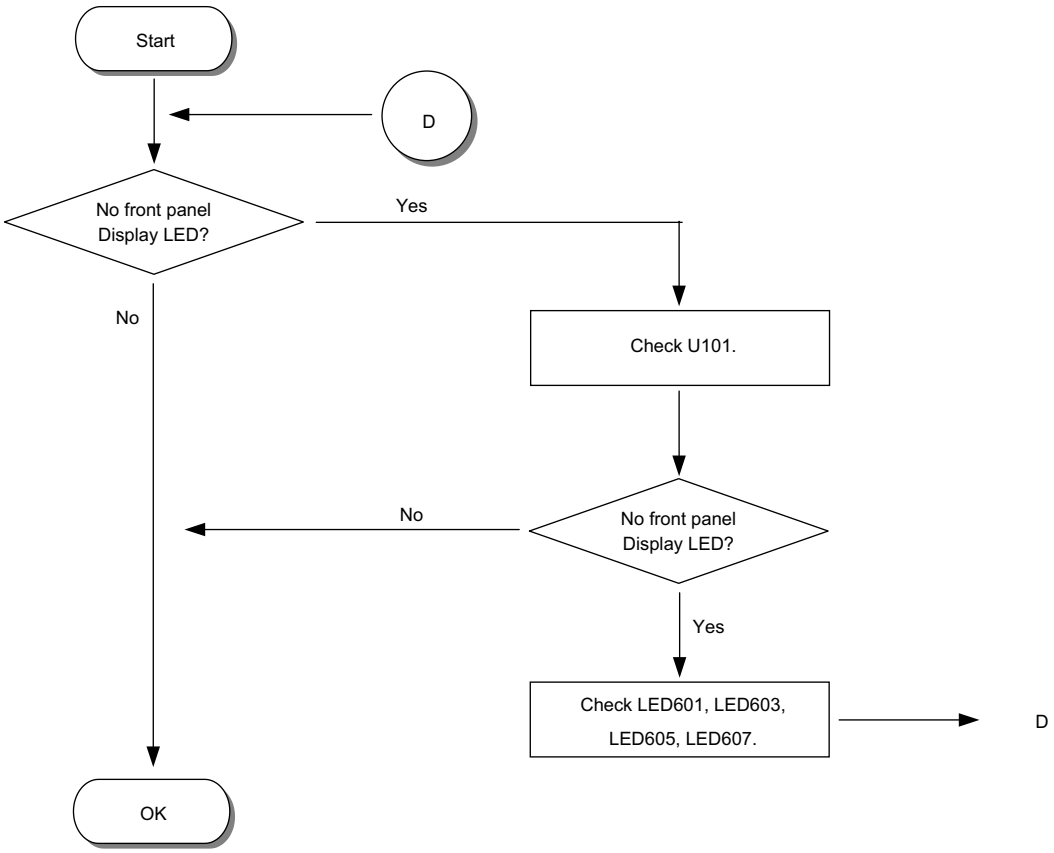
Purpose

To check front and back panel display LEDs.

Required Instrument

DVM

TS Flow Chart



Down Stream Check

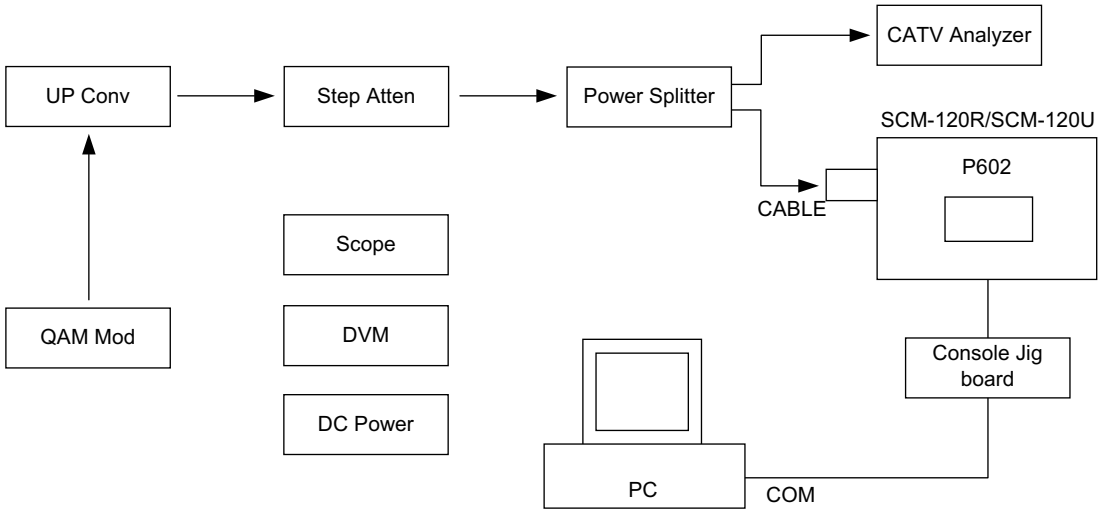
Purpose

To check stream analog signal flow. It is point to check if the AGC circuit in the down stream block works.

Required Instruments

QAM Modulator, Up Converter, Step Attenuator, Power Splitter, CATV Analyzer, PC, Console Jig board, Console cable, RS-232C cable, DC Power Supply, Osciloscope, Digital Volt Meter.

Instruments Connection



Detailed Settngs

QAM Modulator setting (BCM93133)

❶ Case of 64QAM

- QAM_64
- DIGCPHR
- PRBS_23M
- Auto_Sync
- CH : N/A
- SymRate : 5.0569Msps
- α : 0.15
- IF : 44.0
- S : Norm
- i : 32
- j : 4

❷ Case of 256QAM (Choose this case to the following descriptions of the current section)
- QAM_256
- DIGCPHR
- PRBS_23M
- CH : N/A
- SymRate : 5.3605Msps
- α : 0.12
- IF : 44.0
- Auto_Sync
- S : Norm
- i : 32
- j : 4

Up Converter Setting (C6U)

- A 697.2500
- REM NA
- OPT MENU
  - IDLE OFF
  - BAKUP NO
  - L 057358
  - HJ7L 7000
  - REF INT
  - TEST LED
  - TEST IN
  - REV 005
  - C6U
  - PGMA OFF
  - AUXA OFF
  - MODU DIG
  - IMG III III III
  - IAGC OFF
  - MODE FRQ
  - RF ON
  - RF III III III
  - INPT IF
  - SAMSUNG
  - CNVTR A
  - B 697.2500

CATV Analyzer (HP8591C) and Step Attenuator Setting

- Center Frequency : 699MHz
- Frequency Span : 20MHz
- Resolution Bandwidth : 300KHz
- Video Bandwidth : 30KHz
- Press DISPLAY Line Enter.
- Adjust step attenuator so that DISPLAY Line reads 0dBmV on the signal spectrum.

PC Setting

- Get rid of the black rubber cap under the InfoRanger to expose P601 port. Connect the P601 port and the COM port of the PC through the Console Jig board which is provided for the purpose of service. Refer to 'Chapter 5 Using the Diagnostic Program' about this method.
- Activate a Hyperterminal and configure the COM port as follows:
  - BPS : 19200
  - Data Bit : 8
  - Parity : NO
  - Stop Bit : 1
  - Flow Control : NO

InfoRanger Setting

1. The following message should appear momentarily on the Hyper Terminal. Press the [Enter] key in this screen.

```
Diagnostic S/W for SCM Series           Ver 0.0.0

S A M S U N G  E L E C T R O N I C S

Information & Communication Business.

Network Division BNT group



Press a key to start hardware diagnostics.
                      . . . . . .
                      >>     ☞ Press the Enter key.
```

2. Then, the following main menu of the diagnostic program appears.

```
START
============================
a. Memory Test
b. Ethernet Test
c. Miscellaneous Test
d. Cookie
e. Cable Downstream Test
f. Cable Upstream Test
ESC. Exit
============================
```

3. Enter 'e' from the <START>menu to start 'Downstream Main Menu'.

```
Downstream Main Menu
============================
a. Rx SNR Test
b. Read Downstream Register
c. SNR
ESC. Exit
============================
```

4. When the following message appears, enter the 699000000 (699MHz) as a Downstream Frequency and press [Enter] key.

```
Input Frequency : 699000000
```

5. Next, choose 1 for Symbol Rate and press [Enter].

```
5360537=1 ,5056941=2
Input Symbol Rate : 1
```

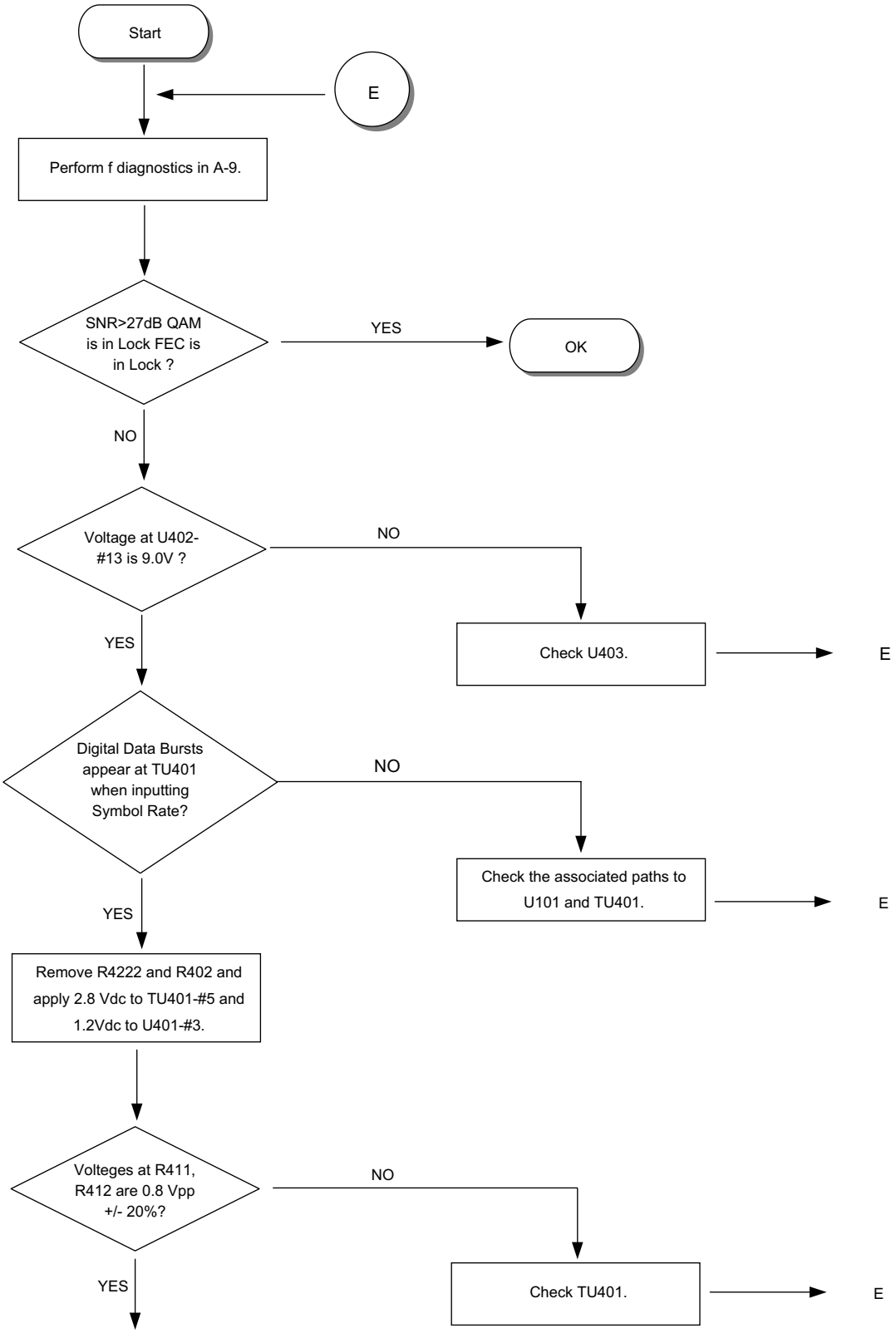
6. When the frequency and the Symbol Rate are normal, the result is displayed as in the following. You can also check the SNR value (ESNO).

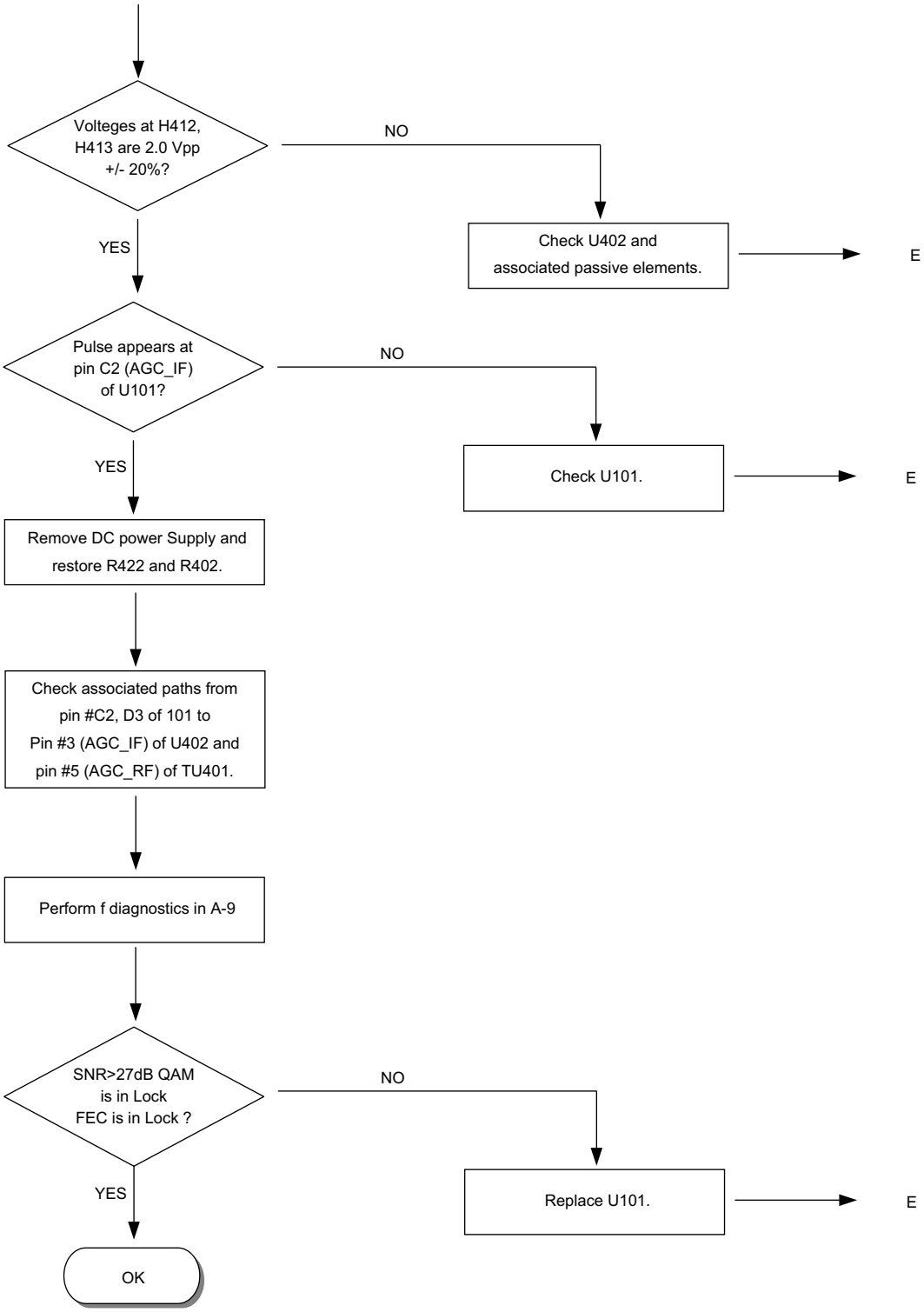
```
5056941
DEMOD LOCKED
TRELLIS LOCKED
FEC LOCKED
MPEG LOCKED
ESNO =  310

Downstream Main Menu
============================
a. Rx SNR Test
b. Read Downstream Register
c. SNR
ESC. Exit
============================
```

Refer to Downstream test in the 'Chapter 5 Using the Diagnostic Program'.

TS Flow Chart




Volteges at H412, H413 are 2.0 Vpp +/- 20%?
NO
Check U402 and associated passive elements.
E
YES
Pulse appears at pin C2 (AGC_IF) of U101?
NO
Check U101.
E
YES
Remove DC power Supply and restore R422 and R402.
Check associated paths from pin #C2, D3 of 101 to Pin #3 (AGC_IF) of U402 and pin #5 (AGC_RF) of TU401.
Perform f diagnostics in A-9
SNR>27dB QAM is in Lock FEC is in Lock ?
NO
Replace U101.
E
YES
OK

Up Stream Check

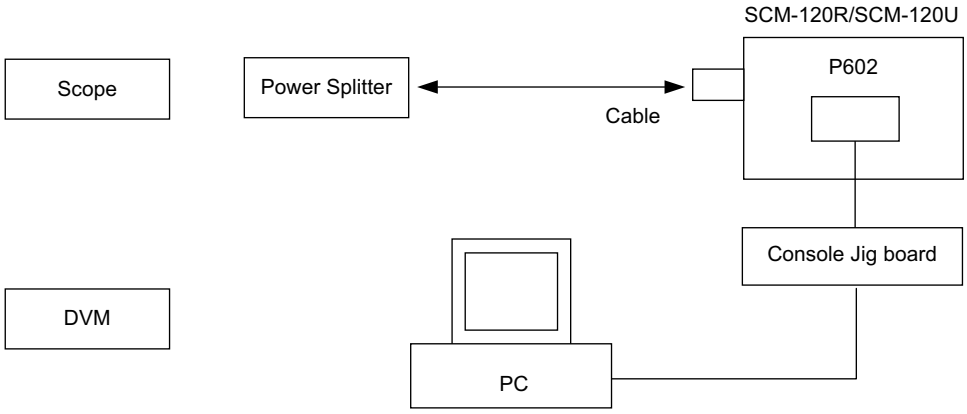
Purpose

To check up stream analog signal flow.

Required Instruments

CATV Analyzer, PC, Console Jig Board, Console cable, RS-232C cable, Oscilloscope, Digital Volt Meter

Instruments Connection



Detailed Settngs

CATV Analyzer (HP8591C)

- Start Frequency : 1MHz
- Stop Frequency : 50MHz
- Resolution Bandwidth : 300KHz
- Video Bandwidth : 30KHz

PC Setting

- Refer to A-9 page, 'PC setting'

InfoRanger Setting

1. After setting the equipment described in A-9 page, the following message should appear momentarily on the Hyper Terminal. Press the [Enter] key in this screen.

```
Diagnostic S/W for SCM Series           Ver 0.0.0

S A M S U N G  E L E C T R O N I C S

Information & Communication Business.

Network Division BNT group

Press a key to start hardware diagnostics.
                      . . . . . .
                      >>     ☞ Press the Enter key.
```

2. Then, the following main menu of the diagnostic program appears.

```
START
============================
a. Memory Test
b. Ethernet Test
c. Miscellaneous Test
d. Cookie
e. Cable Downstream Test
f. Cable Upstream Test
ESC. Exit
============================
```

3. Start the 'Tx Signal' menu by entering 'a' on the <Upstream Main Menu>.

4. When the following message appears, enter the upstream frequency and press [Enter]. The screen below shows an example to enter frequency 10000000.

```
Input Frequency : 10000000
```

5. Second, choose 1 for the Modulation Mode and press [Enter].

```
QPSK : 1 , 16QAM : 2
Input modulation mode : 1
QPSK mode is selected
```

6. Next, select 160 for Symbol Rate and press [Enter].

```
Symbol Rate '160,320,640,1280,2560'
Input Symbol Rate : 160
160 Symrate is selected
```

7. Finally, enter 55dBmV for Output Level and press [Enter].

```
8dBmV - 58dBmV
Input level : 55
output level is 55 dBmV
```

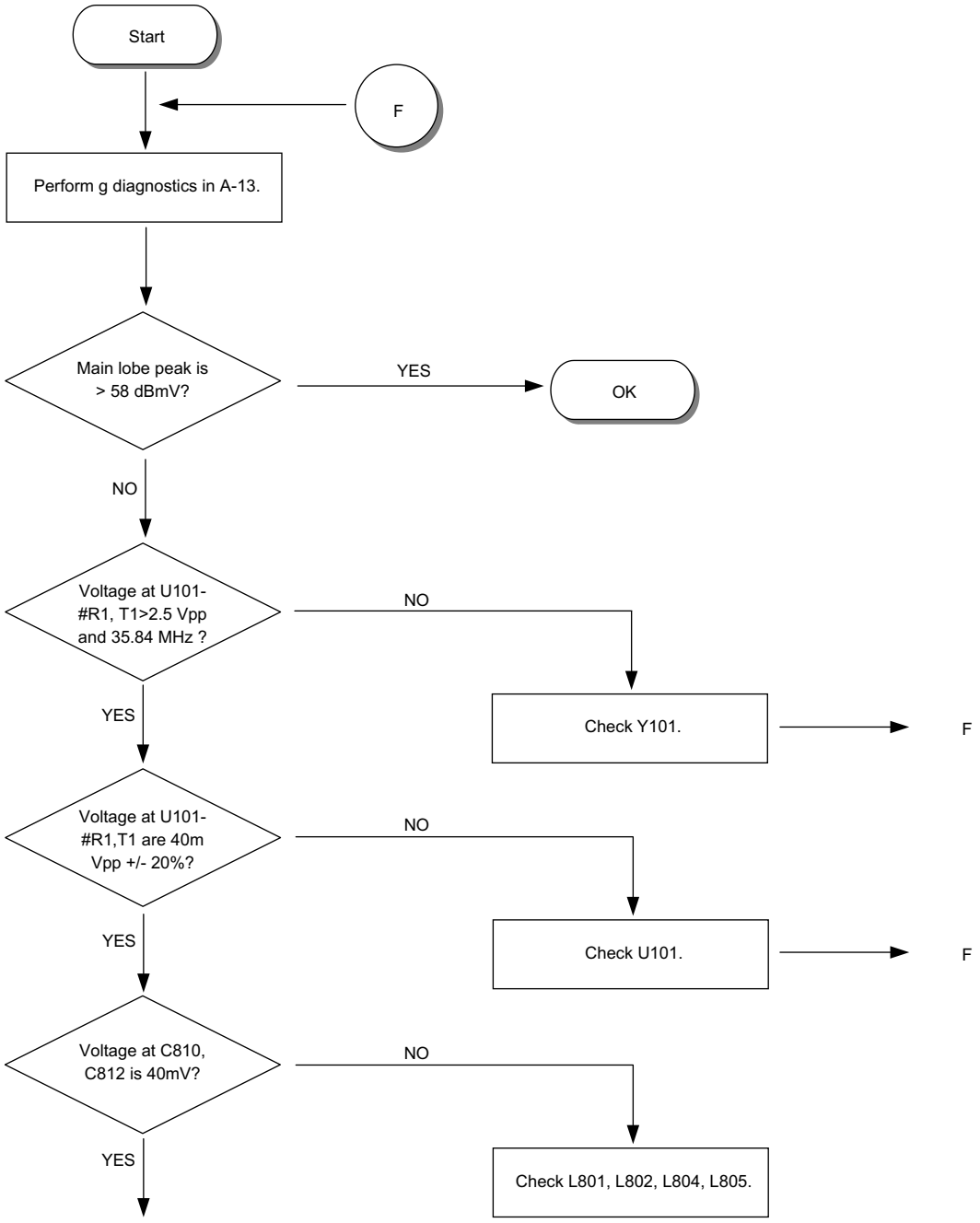
8. When all the parameters are entered, the result is displayed as in the following.

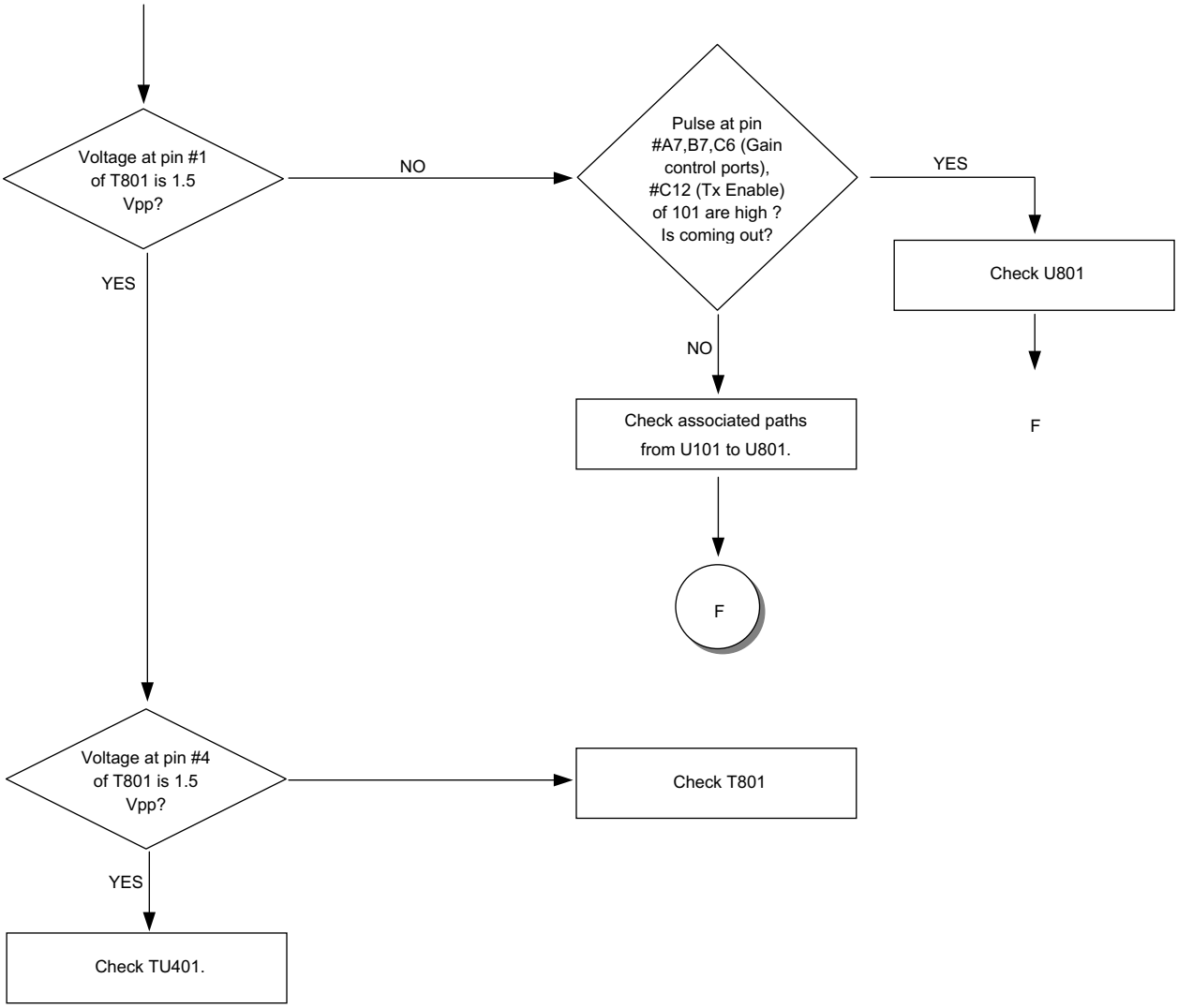
```
Frequency - 10000000 Hz
Output PwrLvl = 55.0 dBmv
```

9. Measure the InfoRanger signal power and check to see if the value is normal.

Refer to Upstream test in the 'Chapter 5 Using the Diagnostic Program'

TS Flow Chart




Voltage at pin #1 of T801 is 1.5 Vpp?
NO
YES
Pulse at pin #A7,B7,C6 (Gain control ports), #C12 (Tx Enable) of 101 are high ? Is coming out?
YES
Check U801
F
NO
Check associated paths from U101 to U801.
F
Voltage at pin #4 of T801 is 1.5 Vpp?
Check T801
YES
Check TU401.

Ping Test

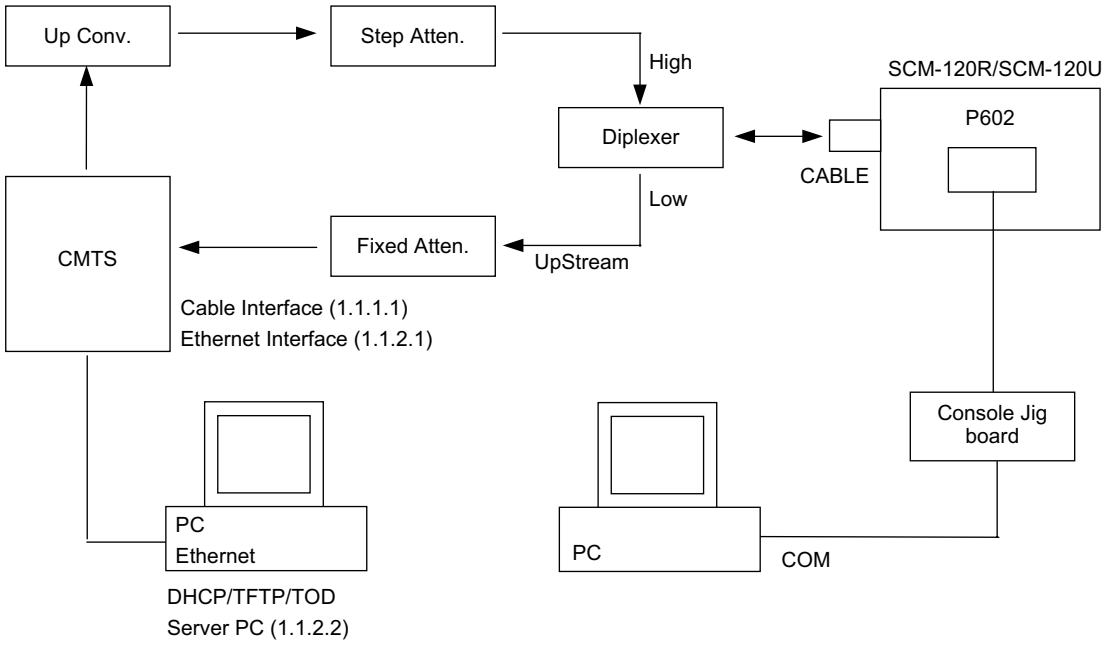
Purpose

To check the connectivity between the cable modem and the Headend (or CMTS).

Required Instruments

Server, CMTS, Up Converter, Step Attenuator, Fixed Attenuator (10dB x 3), Diplexer, CATV Analyzer, PC, Consolg Jig board, Consolg cable, RS-232C cable

Instruments Connection



Detailed Settings

CMTS Setting

- Any DOCSIS-compliant CMTS can be utilized here. Refer to the related manuals of the corresponding CMTS for detailed information on its setup.

Server Setting

- In the Figure above, all the servers (DHCP, TFTP, TOD servers) are installed in a single server with Windows NT, and the Server IP address is set at 1.1.2.2 for the purpose of experiment.

- DHCP Server :

  1. Execute the built-in DHCP server.
  2. After clicking DOMAIN and then MAKE menus, set up the IP address pool which will be allocated to the cable modems connected to the CMTS. The allocated IP addresses should have a common subnet with the Cable Interface IP (here, 1.1.1.xxx).
  3. After clicking DHCP OPTION and then GLOBAL menus, set up ROUTER, TIME SERVER, TIME OFFSET, BOOT FILE NAME by assigning Cable Interface IP Address of CMTS (here, 1.1.1.1), TFTP server IP address (here, 1.1.2.2), time offset between TOD server and cable modems (here, 0), configuration file name (here, samsung.cnf) to them, respectively.

- TFTP Server :
  1. If the TFTP server is not installed in the server, download a TFTP server from the Internet (here, TFTP Server32 Pro V2 from http://www.walusoft.co.uk).
  2. After executing TFTP server, set up outbound directory to where system images and configuration files are located.

- TOD Server:
  1. If the TOD server is not installed in the server, download a TOD server from the Internet (here, TimeSync V2 from http://www.noware.acc.co.at).
  2. After executing TimeSync, set up New SNTP, New Time, New UniTime, New NetRemoteTOD by assigning the server IP address (here, 1.1.2.2) to them respectively.

Step Attenuator Setting

- Adjust step attenuator so that the input signal level is about 0 dBmV

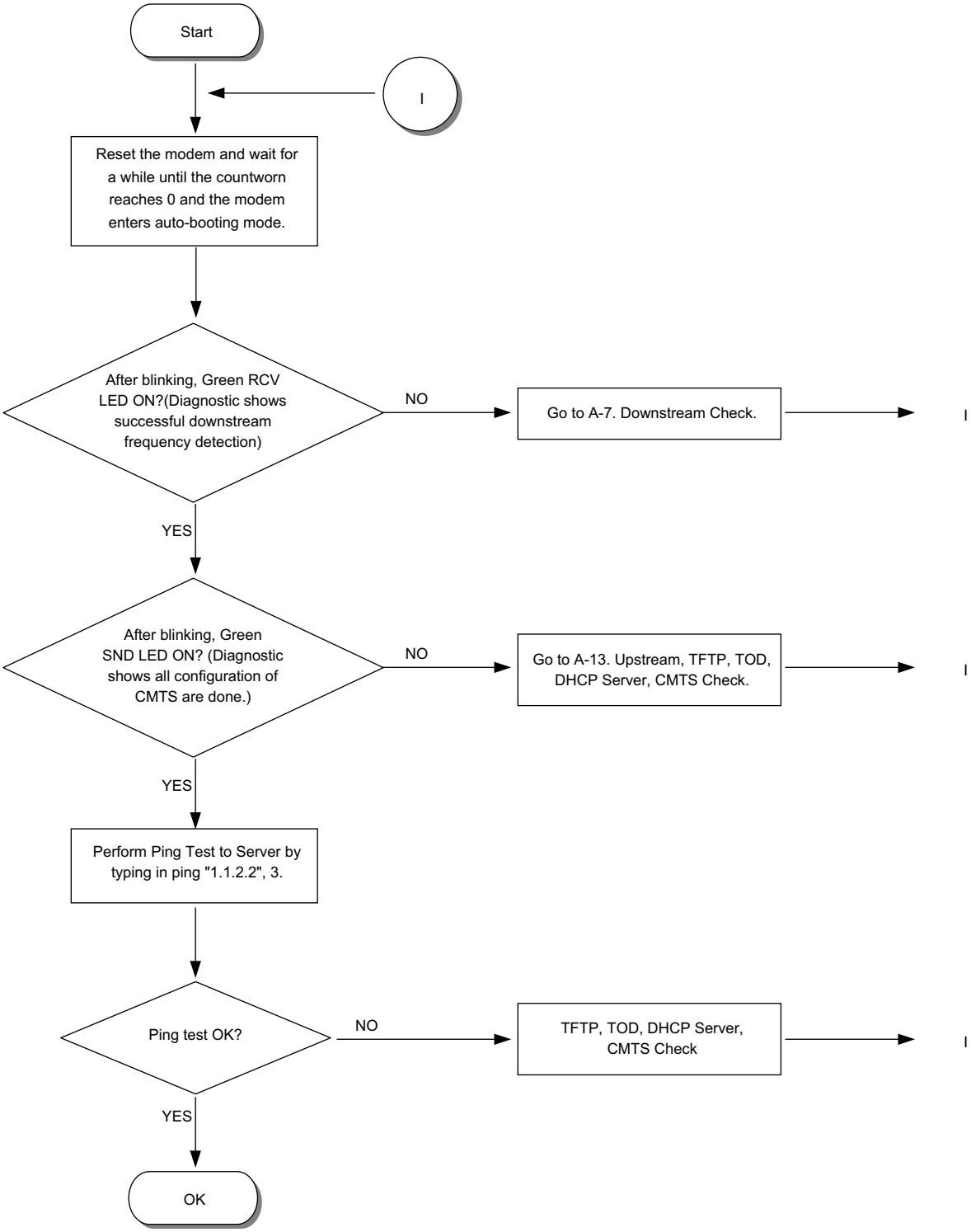
PC Setting

- Get rid of the black rubber cap under the InfoRanger to expose port 602. Connect the P603 port and the COM port of the PC through the Console Jig board which is provided for the purpose of service. Refer to the Chapter 5 of this manual about this method.
- Activate a Hyperterminal and configure the COM port as follows:
  - BPS : 19200
  - Data Bit : 8
  - Parity : NO
  - Stop Bit : 1
  - Flow Control : NO

InfoRanger Setting

- After resetting InfoRanger, enter the auto-booting mode by leaving the countdown to reach 0.

TS Flow Chart


Start
I
Reset the modem and wait for a while until the countworn reaches 0 and the modem enters auto-booting mode.
After blinking, Green RCV LED ON?(Diagnostic shows successful downstream frequency detection)
NO
Go to A-7. Downstream Check.
I
YES
After blinking, Green SND LED ON? (Diagnostic shows all configuration of CMTS are done.)
NO
Go to A-13. Upstream, TFTP, TOD, DHCP Server, CMTS Check.
I
YES
Perform Ping Test to Server by typing in ping "1.1.2.2", 3.
Ping test OK?
NO
TFTP, TOD, DHCP Server, CMTS Check
I
YES
OK

Troubleshooting in Network Layer

NOTE
- **Bold face font** Command to be typed.
- Contents in/* */ Comments to help understanding.

Normal state

→ The InfoRanger works well without any problem

```
Company: SAMSUNG
Product: External Ethernet Cable Modem
Part: 9414    Rev: 7
Target Name: vxTarget
User: target
MAC Code Version 42
ulUsbTraceLevel changing from 0 to 5
ulUsbTraceLevel changing from 5 to 5
USB_load complete
Attached TCP/IP interface to mac unit 1
Attaching network interface lo0... done.
#10060 00:00:00.000 Lvl:7 OEM: OEM Descriptor v2 Found
#10061 00:00:00.000 Lvl:2 Background Timer Set
#10062 00:00:00.000 Lvl:7 OEM: EMAC set to 00:00:f0:3b:d9:bb
#10063 00:00:00.000 Lvl:7 OEM: CMAC set to 00:00:f0:3b:d9:bc
#10064 00:00:00.000 Lvl:7 OEM: USB  set to 00:00:f0:3b:d9:bd
#10065 00:00:00.000 Lvl:7 OEM: Initialization complete
#10066 00:00:00.000 Lvl:6 BPI  Informational: AFSM State Changed to Start State
NFS client support not included.
usrNetInit Done
#10067 00:00:00.290 Lvl:7 Scanning channel  79, 555000000 Hz (Last Good)
#10068 00:00:00.290 Lvl:7 Ethernet Interface is down
#10069 00:00:00.290 Lvl:7 USB Interface is down
#10070 00:00:00.290 Lvl:7 MAC Interface is up
#10071 00:00:00.840 Lvl:7 Downstream Interface is up
#10072 00:00:02.030 Lvl:7 Ethernet Interface is up
#10073 00:00:02.030 Lvl:7 USB Interface is up
#10074 00:00:03.380 Lvl:7 Acquired D/S Freq: 555000000  Mod: QAM 256
#10075 00:00:03.380 Lvl:7 Found UCD ID's: 2, 1
#10076 00:00:05.380 Lvl:7 Upstream Interface is up
#10077 00:00:06.480 Lvl:7 Starting DHCP
#10078 00:00:14.640 Lvl:7 DHCP successful: CM IP: 1.1.10.10
#10079 00:00:14.640 Lvl:7 Starting TOD at 1.1.2.2
#10080 10:21:12.000 Lvl:7 TOD Successful: WED DEC 13 2000 10:21:12
#10081 10:21:12.010 Lvl:7 Starting Tftp Config File Get 'sam0.cnf' at 1.1.2.2
#10082 10:21:12.040 Lvl:7 Config File Get Successful.
#10083 10:21:12.040 Lvl:6 Unrecognized type 5
#10084 10:21:12.050 Lvl:7 Performing check for boot-state based SWUpgrade.
compareFileResult2 = 0
#10085 10:21:12.050 Lvl:7 Starting Registration with temp Sid: 1360
#10086 10:21:12.070 Lvl:7 Reg Rsp OK: Successful
#10087 10:21:12.070 Lvl:7 Service Class: Id 4 SID 1360
#10088 10:21:12.090 Lvl:7 Max CPE set to 15 by config file
#10089 10:21:13.090 Lvl:7 Snmp Cold Start Successful!
#10090 10:21:13.090 Lvl:7 Performing check for post config-file based SWUpgrade.
compareFileResult2 = 0
#10091 10:21:13.090 Lvl:7 *** CM Operational ***
```

No DHCP server

→ InfoRanger has problem with DHCP or TOD and etc...

```
Company: SAMSUNG
Product: External Ethernet Cable Modem
Part: 9414    Rev: 7
Target Name: vxTarget
User: target
MAC Code Version 42
ulUsbTraceLevel changing from 0 to 5
ulUsbTraceLevel changing from 5 to 5
USB_load complete
Attached TCP/IP interface to mac unit 1
Attaching network interface lo0... done.
-> #10319 00:00:00.000 Lvl:7 OEM: OEM Descriptor v2 Found
#10320 00:00:00.000 Lvl:2 Background Timer Set
#10321 00:00:00.000 Lvl:7 OEM: EMAC set to 00:00:f0:3b:d9:bb
#10322 00:00:00.000 Lvl:7 OEM: CMAC set to 00:00:f0:3b:d9:bc
#10323 00:00:00.000 Lvl:7 OEM: USB  set to 00:00:f0:3b:d9:bd
#10324 00:00:00.010 Lvl:7 OEM: Initialization complete
#10325 00:00:00.060 Lvl:6 BPI  Informational: AFSM State Changed to Start State
NFS client support not included.
usrNetInit Done
#10326 00:00:00.350 Lvl:7 Scanning channel  79, 555000000 Hz (Last Good)
#10327 00:00:00.350 Lvl:7 Ethernet Interface is down
#10328 00:00:00.350 Lvl:7 USB Interface is down
#10329 00:00:00.350 Lvl:7 MAC Interface is up
#10330 00:00:00.590 Lvl:7 Downstream Interface is up
#10331 00:00:03.800 Lvl:7 Acquired D/S Freq: 555000000  Mod: QAM 64
#10332 00:00:03.810 Lvl:7 Found UCD ID's: 1, 2
#10333 00:00:05.800 Lvl:7 Upstream Interface is up
#10334 00:00:07.500 Lvl:7 Starting DHCP
#10335 00:01:10.500 Lvl:3 Dhcp sending DISCOVER
dh1: dhcpcBind failed: OK
dhcpCfgQuery: dhcpParamsGet failed: errno = 0x6a0006
#10335 00:01:10.500 Lvl:4 Dhcp dhcpCfgGet Failed
#10336 00:01:11.060 Lvl:2 OEM: system restart
```

Your configuration file for Cable modem should be located in your TFTP server.

```
***********
/* Configuration file may have following items. */
Downstream Frequency
Upstream channel ID
Class of service group                    (mandatory field)
class ID maximum downstream rate          (bit per second)
maximum upstream rate                     (bit per second)
upstream channel priority                 (should be 0-7 with 7 the highest priority)
Guaranteed minimum upstream rate          (bit per second)
Maximum upstream transmit burst           (0-255)
Software upgrade file name
CPE Ethernet MAC address

/* DOCSIS RFI specification also has additional information on configuring file for CMTS. */
```

If you want to set to your down stream frequency,

```
-> sdf 417000000 /* 417 MHz */
```

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Appendix B
Testing InfoRanger

Appendix B Testing InfoRanger

Purpose of the Plan

The purpose of this plan is to outline the various areas of information that is important for the success of Partners Field Trials.

Feature Set

The followings are the current features for Field Trial:

- SNMP Agent for : Filter IP table, Filter LLC table, Dev Filter group
- LED driver
- New cookie
- 64QAM (QPSK)
- Ethernet diagnostics
- DHCP
- MIB values
- Flash
- Boot files
- TOD Entries
- Configuration files (using TFTP)
- VxWorks.st in flash
- nmAccess table filtering
- Flash file system
- Baseline Privacy (RSA encryption)
- Privacy MIB

Typical Hardware Setup

The following is a suggested list of hardware:

- One cable router Headend
- Two InfoRanger line cards
- One C6U upstream converter
- Attenuators
- One diplexer filter
- One splitter
- Two subscriber units (InfoRanger)
- Four IBM compatible PCs
- Four 10BASE-T Ethernet NICs
- Two trisegment hubs
- One router (to be used as a Comserver)
- One master console
- One microweb Server
- One Solaris(UNIX) workstation
- One MS Windows NT4.0 Server
- One rack

InfoRanger Test Topology

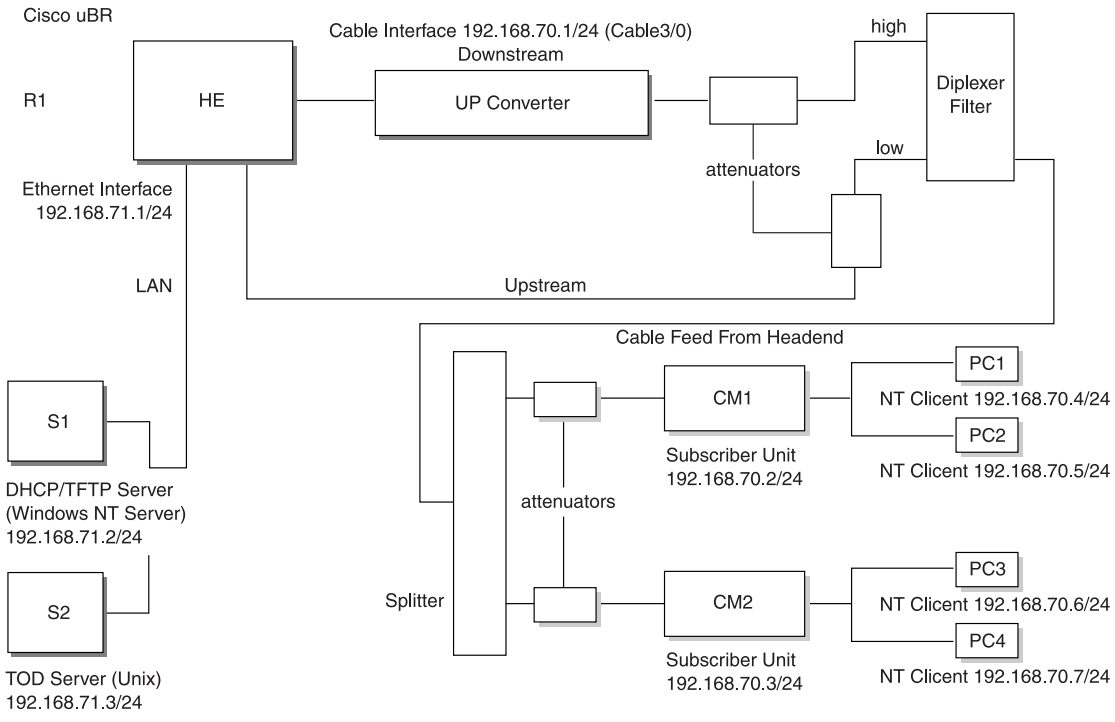


Figure B-1 InfoRanger Test Topology

Typical Suggested Tests

- FTP testing
- Internet access
- TFTP server configuration
- uBR testing routing protocol
- Feature set content
- Security
- Stability
- MIB
- Image upgrade
- Plug and play

Test Environment and Setup Overview

This section describes the test environment and steps that test staff uses to exercise InfoRanger. By comparing the test environment to your own, you can learn how to configure your own environment.

This document provides checklists of environment variables that will be unique to your environment and that you will need to set up your environment. It contains the following sections:

- '**Setting Up the Test Environment**' section describes how to configure the servers and routers in your test environment to accommodate CMRD-based InfoRanger.
- '**Setting up the InfoRanger for the first time**' section describes what you must do to each InfoRanger that you want to test in the test environment.

Setting Up the Test Environment

This section describes how to configure the servers and routers to accommodate the InfoRanger in your test environment. It contains the following sections:

- Understanding the test environment
- Setting up the CMTS
- Setting up the support services

This document does not describe configuration of the security servers needed to support Baseline Privacy.

Understanding the Test Environment

This section describes the test network and identifies variables that will be different in your own test network. The goal of the test environment is to approximate the environment in which MSOs will deploy InfoRanger for test purposes. The main differences between the test environment and the MSO environment are:

- The InfoRanger in the test environment may have access to network servers for initial configuration before they can be tested. For information about initial configuration, see the section '**Setting up the InfoRanger for the first time**' section.
- The InfoRanger in the test environment may be equipped with serial ports for testing via a terminal connected directly to the serial port or via a communication server. The InfoRanger may not include serial ports when deployed by MSOs, and the diagnostics software may not be included in the software images installed in the InfoRanger.

The test environment does not represent the development systems used to create system images for the InfoRanger. Figure B-1 presents the test environment used by Samsung's test staff. This test environment uses IP addresses reserved by the Internet Assigned Numbers Authority(IANA) for private internets.
For details on the reserved IP addresses, see RFC 1918. You can use these IP addresses for test purposes or, if connectivity with the Internet is required, you can use your own IP address.

Setting Up the Headend

Make sure the CMTS line card is equipped with the latest supported software image, and that the images loaded into the InfoRanger and your TFTP server are compatible with it. For details on loading software images into your Cisco uBR, see the Cisco uBR documentation. In the test environment shown in Figure B-1, the uBR configuration file contains the following configuration entries for the Cable 3/0 interface:

```
interface Cable3/0
ip address 192.168.70.1 255.255.255.0
ip helper-address 192.168.71.2
no ip redirects
no ip proxy-arp
ip pim dense-mode
no ip route-cache
no ip mroute-cache
no keepalive
shutdown
cable insertion-interval 500
cable downstream annex B
cable downstream modulation 64qam
cable downstream interleave-depth 32
cable upstream 0 frequency 10000000
cable upstream 0 power-level 10
cable upstream 0 modulation-profile 1
no cable upstream 0 shutdown
```

For other cable interface configuration, see your uBR documentation.

About the Up Converter, Diplexer, and Attenuators

To ensure that the upstream and downstream frequencies at the headend match the frequencies at the InfoRanger, the test environment includes an up converter.
The example test environment (see Figure B-1), employs a General Instrument C6U up converter, which has two downstream channels, A and B. One C6U therefore supports two line cards, each transmitting on two different channels.

The downstream frequency is selected based on the channel selected on the up converter. For example, Channel 107 (Jerold channel number), in the EIA column 673.25 (MHz), EIA channel 104 for the HP analyzer. The C6U should be set on STD and DIG. The headend usually generates downstream signal power of up to 40 dbmv at 44 MHz. The Up Converter generates a 55-860 MHz signal to the network. Generally, the proper input to the InfoRanger is maintained around 0 dbmv. If the input falls below -15 dbmv (a very rare occurance), install amplifying elements to boost it. Attenuators are fastened to the high end of the diplexer filter, which feeds the downstream channel. The InfoRanger upstream output is typically much less than 50 dbmv. The DOCSIS specifications require attenuation to accommodate less than 35 dbmv at 5-42 MHz. The upstream signal input power to the headend should be close to 10 dbmv.

All components contribute to the overall signal attenuation, in addition to the attenuators. From a InfoRanger's perspective, the diplexer filter is a signal separator of high (55-860 MHz) and low (7-42MHz) frequencies. Splitters also contribute to signal attenuation. Table B-1 lists the amount of attenuation contributed by common splitters. Diplexers typically contribute 1dB of attenuation and coax wire contributes attenuation that varies with signal frequency.

Splitter Type	Attenuation
2-way	3.5dB per port
3-way	7dB on 2 port+3.5dB on the third or 5 dB on all three ports
4-way	7dB per port
8-way	10.5dB or 11dB port
16-way	14dB per port

Table B-1 Splitter Attenuation list

Setting Up the Support Services

This section describes how support services are configured to accommodate InfoRanger in the test environment. It contains the following sections:

- Setting up the TFTP server
- Setting up the DHCP server
- Setting up the TOD server

Setting Up the TFTP Server

The TFTP server (S1 in Figure B-1) needs to provide system images and configuration files required by DOCSIS-compliant cable modems, CM1 and CM2. In the test example, the current InfoRanger system image (vxworks.st) and configuration file (test.cnf) are installed on the TFTP server (IP address 198.168.71.2), an NT server running DHCP server.

If you want to download a new system image to the InfoRanger from the TFTP server, you must either use an SNMP management system to initiate the download or change the system image file name and include the new file name in the InfoRanger configuration file so that InfoRanger will know that a new system image is available. For general information about DOCSIS-compliant configuration file, refer to Appendix C in the DOCSIS specification.

For security purposes, use the TFTP server configuration parameter RESTRICT-ACCESS (or the equivalent) to restrict TFTP access to specific directories. If RESTRICT-ACCESS is not configured, all "world- readable" files are accessible to TFTP clients. On the CDDM TFTP server, the RESTRICT-ACCESS parameter is enabled by default.

Setting Up the DHCP Server

The DHCP server (S1) needs to provide IP configuration data for InfoRanger CM1 and CM2. The following table lists the configuration parameters that the DHCP server must supply for CM1 and CM2: You may also configure the DHCP server to provide network configuration parameters for hosts (PCs1-4) connected to each InfoRanger's LAN interface. In the test example, a Windows NT server (IP address 198.168.71.2/24) with DHCP server plays the role of the DHCP server. For each InfoRanger, there is a corresponding "static" DHCP entry that maps the IP configuration parameters to the InfoRanger's MAC address. "Static" leases cannot be assigned to any device other than the one with the specified MAC address, even if the lease expires.

To assign the static IP address to a specific InfoRanger, the MAC addresses of CM1 and CM2 must be known. The predetermined MAC addresses are programmed into each InfoRanger's "cookie".

For more details on DHCP, see the following RFCs:

- RFC 2131, Dynamic Host Configuration Protocol
- RFC 2132, DHCP Options and BOOTP Vendor Extensions

Parameter	CM1	CM2
MAC Address	00:e0:1e:ab:2c:ae	00:e0:1e:ab:2d:ae
IP Address	192.168.70.2	192.168.70.3
Subnet Mask	255.255.255.0	255.255.255.0
Default Route	192.168.70.1	192.168.70.1
Time Server	192.168.71.3	192.168.71.3
Time Offset	-28800(PST)	-28800(PST)
TFTP server	192.168.71.2	192.168.71.2
Config file	test.cnf	test.cnf
TFTP directory	/multinet/tftp	/multinet/tftp

Setting Up the TOD Server

The TOD server (S2) needs to provide time service to InfoRanger CM1 and CM2. Time stamps are required internally for regular CM functions such as DHCP lease renewal times and logging CM events. In the test example, S2 is a Unix server (IP address 198.168.71.3). Windows NT systems may require additional software such as the RCC Time server. Aside from making sure the TOD server is running, no unique configuration is required. For more details on TOD service, see RFC-868.

Configuring the Client PCs

In the test environment the PC clients, which represent residential hosts "behind" InfoRanger, can be configured manually as well as automatically with predetermined IP connectivity parameters (IP address, subnet mask, DNS server list, default gateways). The following table lists the parameters manually configured in the four client PCs:

All client PCs specify the IP address of the CMTS cable interface (192.168.70.1) as the default router. In the test environment all four clients use the S1(IP address 192.168.71.2) as DNS servers, a Windows NT server running DHCP server.

Parameter	PC1	PC2	PC3	PC4
IP Address	192.168.70.4	192.168.70.5	192.168.70.6	192.168.70.7
Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0	255.255.255.0
Default Route	192.168.70.1	192.168.70.1	192.168.70.1	192.168.70.1
DNS Server	192.168.71.2	192.168.71.2	192.168.71.2	192.168.71.2

Setting Up InfoRanger for the First Time

This section describes what you must do to each InfoRanger that you want to test in the test environment. Before you install InfoRanger in the test environment, configure the InfoRanger with the following :

- Programmed cookie (MAC address, serial number).
- Boot Monitor image and system image in Flash bank 1

On test InfoRanger equipped with serial interface and diagnostics software, use the InfoRanger hardware diagnostic utility to program the cookie and copy images into Flash memory. In manufacturing environment, the images may be written to Flash memory before installation in the InfoRanger.

To initially download images into Flash memory, InfoRanger must access to the TFTP server via their Ethernet interfaces.

To Begin the Debugging Process

All reported problems must contain basic information about the environment. The information requested in the "Basic Information" section below is the commands used at modem console and REQUIRED when reporting any problems. Issue the commands and capture the output to forward to Samsung support.

Basic Information

- Issue the command **version** command at the InfoRanger console prompt to display the OS version information.
- Issue the command **ifShow** command at the InfoRanger console prompt to display the detailed information of the interface register.
- Issue the command **netHelp** command to show the network commands.
- Issue the command **upStat** to display the upstream information.
- Issue the command **dmdStat** to display the downstream information.
- Issue the command **helpStat** to print out the commands related to the statistics.

InfoRanger Resets

To reconfigure the InfoRanger, run **reboot** or press **Ctrl+x**.

Gathering Debug Information

This section describes commands that can be used to gather more information when a problem occurs. Providing as much information as possible when first reporting the problem will facilitate a quick problem resolution. Not all commands will apply to all situations. When in doubt, provide output from ALL the debugging commands listed in this section. Samsung support may request more specific information as the diagnosis of the problem progresses.

Begin by Describing the Problem

- Describe what actually occurs. Describe the expected behavior.
- Provide an EXACT description of the steps needed to reproduce the problem.
- Provide any error messages that are generated.
- Use the logging facilities described below to capture more information, if applicable
- Provide a log of the steps used to reproduce the problem, along with any messages or errors, if possible.

Tracing the Module Status

setTrace x,y is a command to observe the operating status of each module of InfoRanger. The first parameter specifies each module and the second parameter, debug level, specifies how much in detail to trace the module. The higher the debug level is, the more specifically you can trace the module.

(Example) setTrace 8,7 : Trace a message with a level 7, which occurred in module 8 of InfoRanger.

Module	Number	Debug level
BSP	1	0-19
CMAC	2	0-19
EMAC	3	0-19
FLASH	4	0-19
GPIO	5	0-19
I2C	6	0-19
SNARF	7	0-19
CMMSG	8	0-19
DMD	9	0-19
FIR	10	0-19
OEMAPI	11	0-19
REKEY	12	0-19
TUNER	13	0-19
UPHY	14	0-19
OEMBRG	15	0-19
PCPIPE	16	0-19
USB	17	0-19
ALL	19	0-19

It is true that the higher the debug level is, you can trace the module more specifically. To raise the debug level excessively, however, may drop off in performance of the infoRanger and even cause reconfigure of the infoRanger.

To stop tracing, set the debug level 0. For example, to stop tracing according to [**setTrace 8,7**], set [**setTrace 8,0**].

Appendix C
Part List

Appendix C Part List

InfoRanger SCM-120R Part List

Level	Part No	Quantity	Description	Specification
0	SCM120RA2M/XAR			
1	GL92-00055A	1	PBA MAIN	SCM120RA2M/XAR,STA,USA,SCM120RA2M/XAR,DATA,20 BULK,4 LAYER FOR DOGUB,150 X 130 M
2	0402-001056	1	DIODE-RECTIFIER	MBRS140,40V,1A,CASE403A,TP
2	0402-001056	1	DIODE-RECTIFIER	MBRS140,40V,1A,CASE403A,TP
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	1105-001305	1	IC-DRAM	4S641632,1Mx16x4Bit,TSOP,54P,400MIL,8nS,3.3V, 10%,PLASTIC,0to+70C,1mA,CMOS,TP
2	1107-001234	1	IC-FLASH MEMORY	28F320,2Mx16Bit,TSOP,48P,472MIL,100nS,3V, -,PLASTIC,-40to+85C,25uA,CMOS,TP
2	1201-000167	1	IC-OP AMP	358,SOP,8P,150MIL,DUAL,100V/mV
2	1201-001675	1	IC-PREAMP	3510,QSOP,20P,150MIL,-,27dB,PLASTIC,5.25V, 1067mA,-40to+85C,-,-,-100uA,-,-
2	1203-000370	1	IC-NEGA.FIXED REG.	78M05,DPAK,3P,-,PLASTIC,4.8/5.
2	1203-000375	1	IC-POSI.FIXED REG.	78L09,TO-92,3P,190MIL,PLASTIC,8.6/9.4V, -,0TO+150C,2.2A,-,TP
2	1203-001359	1	IC-POSI.FIXED REG.	1086,TO-263,3P,15.8MM,PLASTIC,
2	1203-001426	1	IC-POSI.FIXED REG.	7805,DPAK,3,-,PLASTIC,4.8/5.2V
2	1203-001440	1	IC-POWER SUPERVISOR	708,SO-89,8P,4.9*6.0,PLASTIC,-
2	1203-001447	1	IC-POSI.FIXED REG.	2596,TO-263,5P,-,PLASTIC,3.135
2	1203-001544	1	IC-DC/DC CONVERTER	TK11819M,SOT-23L,6P,150MIL,PLA
2	1203-001998	1	IC-SWITCH VOL. REG.	2596,TO-263,5P,-,PLASTIC,-,-,-40to+125C,3A,-,TP
2	1205-001861	1	IC-MODEM	CN9414,BGA,264P,1062MIL,PLASTIC,3.6V, -,0to+70C,TR,-
2	1205-001864	1	IC-TRANSCEIVER	LXT972LC,QFP,64P,393MIL,PLASTIC,3.45V, -,0to+70C,TR,-
2	1209-001180	1	IC-ETC, LINEAR	UPC2798GR,SSOP,20P,225MIL,PLAS
2	2007-000040	1	R-CHIP	150ohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608

Level	Part No	Quantity	Description	Specification
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000060	1	R-CHIP	100Kohm,1%,1/16W,DA,TP,1608
2	2007-000060	1	R-CHIP	100Kohm,1%,1/16W,DA,TP,1608
2	2007-000067	1	R-CHIP	15Kohm,1%,1/16W,DA,TP,1608
2	2007-000067	1	R-CHIP	15Kohm,1%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000071	1	R-CHIP	22ohm,5%,1/16W,DA,TP,1608
2	2007-000071	1	R-CHIP	22ohm,5%,1/16W,DA,TP,1608
2	2007-000080	1	R-CHIP	2Kohm,5%,1/16W,DA,TP,1608
2	2007-000080	1	R-CHIP	2Kohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608

Level	Part No	Quantity	Description	Specification
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000570	1	R-CHIP	220ohm,1%,1/16W,DA,TP,1608
2	2007-000570	1	R-CHIP	220ohm,1%,1/16W,DA,TP,1608
2	2007-000583	1	R-CHIP	22Kohm,1%,1/16W,DA,TP,1608
2	2007-000683	1	R-CHIP	3.3Kohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-001014	1	R-CHIP	51ohm,5%,1/16W,DA,TP,1608
2	2007-001134	1	R-CHIP	68ohm,5%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608

Level	Part No	Quantity	Description	Specification
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000298	1	C-CERAMIC,CHIP	10uF,+80-20%,16V,Y5V,TP,3225,-
2	2203-000298	1	C-CERAMIC,CHIP	10uF,+80-20%,16V,Y5V,TP,3225,-
2	2203-000315	1	C-CERAMIC,CHIP	0.12nF,5%,50V,NP0,TP,1608
2	2203-000315	1	C-CERAMIC,CHIP	0.12nF,5%,50V,NP0,TP,1608
2	2203-000384	1	C-CERAMIC,CHIP	0.015nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-

Level	Part No	Quantity	Description	Specification
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000455	1	C-CERAMIC,CHIP	1nF,5%,50V,NP0,TP,2012
2	2203-000509	1	C-CERAMIC,CHIP	0.0022nF,0.25pF,50V,NP0,TP,1608
2	2203-000626	1	C-CERAMIC,CHIP	0.022nF,5%,50V,NP0,TP,1608
2	2203-000626	1	C-CERAMIC,CHIP	0.022nF,5%,50V,NP0,TP,1608
2	2203-000681	1	C-CERAMIC,CHIP	0.027nF,5%,50V,NP0,TP,1608
2	2203-000681	1	C-CERAMIC,CHIP	0.027nF,5%,50V,NP0,TP,1608
2	2203-000681	1	C-CERAMIC,CHIP	0.027nF,5%,50V,NP0,TP,1608
2	2203-000715	1	C-CERAMIC,CHIP	3.3nF,10%,50V,X7R,TP,1608,-
2	2203-000730	1	C-CERAMIC,CHIP	0.0039nF,0.25pF,50V,NP0,TP,1608
2	2203-000761	1	C-CERAMIC,CHIP	330nF,10%,16V,X7R,TP,2012,-
2	2203-000783	1	C-CERAMIC,CHIP	0.33nF,5%,50V,NP0,TP,1608
2	2203-000783	1	C-CERAMIC,CHIP	0.33nF,5%,50V,NP0,TP,1608
2	2203-001071	1	C-CERAMIC,CHIP	0.056nF,5%,50V,NP0,TP,1608
2	2203-001071	1	C-CERAMIC,CHIP	0.056nF,5%,50V,NP0,TP,1608
2	2203-001408	1	C-CERAMIC,CHIP	0.27nF,5%,50V,NP0,TP,1608
2	2203-001408	1	C-CERAMIC,CHIP	0.27nF,5%,50V,NP0,TP,1608
2	2203-001607	1	C-CERAMIC,CHIP	0.22nF,5%,50V,NP0,TP,1608
2	2203-001683	1	C-CERAMIC,CHIP	0.068nF,5%,50V,NP0,TP,1608
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-

Level	Part No	Quantity	Description	Specification
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005457	1	C-CERAMIC,CHIP	1nF,10%,2KV,X7R,TP,4525,-
2	2401-002127	1	C-AL	220uF,20%,35V,LZ,TP,10x12.5mm,-
2	2401-002127	1	C-AL	220uF,20%,35V,LZ,TP,10x12.5mm,-
2	2401-003400	1	C-AL	330uF,20%,25V,LZ,TP,10x12.5,5
2	2401-003400	1	C-AL	330uF,20%,25V,LZ,TP,10x12.5,5
2	2401-003400	1	C-AL	330uF,20%,25V,LZ,TP,10x12.5,5
2	2402-000144	1	C-AL,SMD	3.3uF,20%,50V,GP,TP,4.3x4.3x5.
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4

Level	Part No	Quantity	Description	Specification
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2601-001056	1	TRANS-SMD,PULSE	350uH,-,1:1,1:1,12.7x6.73x5.97mm,TP
2	2603-000051	1	TRANS-MATCHING	50ohm,1:1,-,2P:3P,6.9x6.9x4.4mm,TP
2	2703-000137	1	INDUCTOR-SMD	150nH,10%,2.92x2.79x2.29mm
2	2703-000206	1	INDUCTOR-SMD	39nH,10%,2.92x2.79x2.29mm
2	2703-000206	1	INDUCTOR-SMD	39nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000246	1	INDUCTOR-SMD	820nH,10%,2.92x2.79x2.29mm
2	2703-000246	1	INDUCTOR-SMD	820nH,10%,2.92x2.79x2.29mm
2	2703-000301	1	INDUCTOR-SMD	2.7uH,10%,0.8x1.6x0.8mm
2	2703-000350	1	INDUCTOR-SMD	10uH,20%,7.3x7.3x4.75mm
2	2703-000350	1	INDUCTOR-SMD	10uH,20%,7.3x7.3x4.75mm
2	2703-000350	1	INDUCTOR-SMD	10uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000353	1	INDUCTOR-SMD	47uH,20%,7.3x7.3x4.75mm
2	2703-000403	1	INDUCTOR-SMD	22uH,10%,3.2x2.5x2.2mm
2	2703-000403	1	INDUCTOR-SMD	22uH,10%,3.2x2.5x2.2mm
2	2703-000403	1	INDUCTOR-SMD	22uH,10%,3.2x2.5x2.2mm
2	2703-001689	1	INDUCTOR-SMD	1.2mH,20%,6.0x6.0x4.3mm
2	2703-002089	1	INDUCTOR-SMD	47uH,20%,12.0x12.0x4.3mm
2	2801-003925	1	CRYSTAL-SMD	35.84MHz,30ppm,28-AAN,20pF,80ohm,TP
2	2904-001111	1	FILTER-SAW AV	43.75MHz,SIP5P,ST,14.5dB,DIGIT

Level	Part No	Quantity	Description	Specification
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE ,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE ,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE ,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE ,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE ,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE ,0.5OHM
2	3404-001075	1	SWITCH-TACT	12V,50mA,160gf,6x6x5.85mm,SPST
2	3711-000956	1	CONNECTOR-HEADER	BOX,4P,1R,2.5MM,ANGLE,SN
2	3711-001361	1	CONNECTOR-HEADER	NOWALL,20P,2R,2.54mm,STRAIGHT,
2	3722-000117	1	JACK-DC POWER	3P,3.5mm,AG,BLK,NO
2	3722-001399	1	JACK-MODULAR	8P/8C,STANDARD,Y,ANGLE,STANDARD,N,BLK,AUF
2	4715-000127	1	SURGE ABSORBER	300V,15%,500A,-,-
2	4715-000127	1	SURGE ABSORBER	300V,15%,500A,-,-
2	GL39-40002A	1	CBF HARNESS	SCM-100R,ROUND,UL E105829,1,83
2	GL40-00011A	1	TUNER	4737PY5-3X8743,SCM-120R,-,-,-,-,75OHM,-,F-CONN.,-,-,BK,-,V159,U466MHZ,43DB(VOLTA)
2	GL41-00015A	1	PCB-MAIN	SCM-120R,FR-4,4L,-,1.6T,150x130 mm,-,1,PCB,-
2	GL44-00012A	1	ADAPTOR-SCM-120R	SCM-120R,14.4W,120VAC,12VDC,1.2A,-,-,60Hz, -,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-
2	GL68-00055A	1	MANUAL-USERS(SCM-120R)	SCM-120R,SEC,ENG,USA,MOJO,-,W130,L175, VER.0A,-,-,-

InfoRanger SCM-120U Part List

Level	Part No	Quantity	Description	Specification
0	SCM120UA2M/XAR			
1	GL92-00078A+B309	1	PBA MAIN	SCM120UA3M,-,-,SCM120UA3M,DATA,FOR DOGUB BOM,4 LAYER,150 X 130 MM,SCM-120RA
2	0402-001056	1	DIODE-RECTIFIER	MBRS140,40V,1A,CASE403A,TP
2	0402-001056	1	DIODE-RECTIFIER	MBRS140,40V,1A,CASE403A,TP
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0601-001262	1	LED	CHIP,GRN,2.0x1.5mm,560nm
2	0801-002366	1	IC-CMOS LOGIC	74LVX08,AND GATE,SOP,14P,400MI
2	1006-001211	1	IC-TRANSIENT SUPPRESSOR	75240,3A,520mW,8P,TSSOP,173MIL,TP
2	1105-001305	1	IC-DRAM	4S641632,1Mx16x4Bit,TSOP,54P,400MIL,8nS,3.3V, 10%,PLASTIC,0to+70C,1mA,CMOS,TP
2	1107-001234	1	IC-FLASH MEMORY	28F320,2Mx16Bit,TSOP,48P,472MIL,100nS,3V, -,PLASTIC,-40to+85C,25uA,CMOS,TP
2	1201-000167	1	IC-OP AMP	358,SOP,8P,150MIL,DUAL,100V/mV
2	1201-001675	1	IC-PREAMP	3510,QSOP,20P,150MIL,-,27dB, PLASTIC,5.25V,1067mA,-40to+85C,-,-,-100uA,-,-
2	1203-000370	1	IC-NEGA.FIXED REG.	78M05,DPAK,3P,-,PLASTIC,4.8/5.
2	1203-000375	1	IC-POSI.FIXED REG.	78L09,TO-92,3P,190MIL,PLASTIC,8.6/9.4V, -,0TO+150C,2.2A,-,TP
2	1203-001359	1	IC-POSI.FIXED REG.	1086,TO-263,3P,15.8MM,PLASTIC,
2	1203-001426	1	IC-POSI.FIXED REG.	7805,DPAK,3,-,PLASTIC,4.8/5.2V
2	1203-001440	1	IC-POWER SUPERVISOR	708,SO-89,8P,4.9*6.0,PLASTIC,-
2	1203-001447	1	IC-POSI.FIXED REG.	2596,TO-263,5P,-,PLASTIC,3.135
2	1203-001544	1	IC-DC/DC CONVERTER	TK11819M,SOT-23L,6P,150MIL,PLA
2	1203-001998	1	IC-SWITCH VOL. REG.	2596,TO-263,5P,-,PLASTIC,-,-,-40to+125C,3A,-,TP
2	1205-001861	1	IC-MODEM	CN9414,BGA,264P,1062MIL,PLASTIC,3.6V, -,0to+70C,TR,-
2	1205-001864	1	IC-TRANSCEIVER	LXT972LC,QFP,64P,393MIL,PLASTIC,3.45V, -,0to+70C,TR,-
2	1209-001180	1	IC-ETC, LINEAR	UPC2798GR,SSOP,20P,225MIL,PLAS
2	2007-000040	1	R-CHIP	150ohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000043	1	R-CHIP	1Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608

Level	Part No	Quantity	Description	Specification
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000052	1	R-CHIP	10Kohm,1%,1/16W,DA,TP,1608
2	2007-000060	1	R-CHIP	100Kohm,1%,1/16W,DA,TP,1608
2	2007-000060	1	R-CHIP	100Kohm,1%,1/16W,DA,TP,1608
2	2007-000067	1	R-CHIP	15Kohm,1%,1/16W,DA,TP,1608
2	2007-000067	1	R-CHIP	15Kohm,1%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000070	1	R-CHIP	0ohm,5%,1/16W,DA,TP,1608
2	2007-000071	1	R-CHIP	22ohm,5%,1/16W,DA,TP,1608
2	2007-000071	1	R-CHIP	22ohm,5%,1/16W,DA,TP,1608
2	2007-000080	1	R-CHIP	2Kohm,5%,1/16W,DA,TP,1608
2	2007-000080	1	R-CHIP	2Kohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608

Level	Part No	Quantity	Description	Specification
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000113	1	R-CHIP	33ohm,5%,1/16W,DA,TP,1608
2	2007-000239	1	R-CHIP	1.5Kohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000287	1	R-CHIP	100ohm,1%,1/16W,DA,TP,1608
2	2007-000570	1	R-CHIP	220ohm,1%,1/16W,DA,TP,1608
2	2007-000570	1	R-CHIP	220ohm,1%,1/16W,DA,TP,1608
2	2007-000583	1	R-CHIP	22Kohm,1%,1/16W,DA,TP,1608
2	2007-000683	1	R-CHIP	3.3Kohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000763	1	R-CHIP	330ohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608
2	2007-000869	1	R-CHIP	4.7Kohm,1%,1/16W,DA,TP,1608

Level	Part No	Quantity	Description	Specification
2	2007-001014	1	R-CHIP	51ohm,5%,1/16W,DA,TP,1608
2	2007-001134	1	R-CHIP	68ohm,5%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-001164	1	R-CHIP	75ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-002899	1	R-CHIP	10ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2007-007226	1	R-CHIP	49.9ohm,1%,1/16W,DA,TP,1608
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000206	1	C-CERAMIC,CHIP	100nF,10%,50V,X7R,TP,2012
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000257	1	C-CERAMIC,CHIP	10nF,10%,50V,X7R,TP,1608
2	2203-000298	1	C-CERAMIC,CHIP	10uF,+80-20%,16V,Y5V,TP,3225,-
2	2203-000298	1	C-CERAMIC,CHIP	10uF,+80-20%,16V,Y5V,TP,3225,-
2	2203-000315	1	C-CERAMIC,CHIP	0.12nF,5%,50V,NP0,TP,1608
2	2203-000315	1	C-CERAMIC,CHIP	0.12nF,5%,50V,NP0,TP,1608

Level	Part No	Quantity	Description	Specification
2	2203-000384	1	C-CERAMIC,CHIP	0.015nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000426	1	C-CERAMIC,CHIP	0.018nF,5%,50V,NP0,TP,1608
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000440	1	C-CERAMIC,CHIP	1nF,10%,50V,X7R,TP,1608,-
2	2203-000455	1	C-CERAMIC,CHIP	1nF,5%,50V,NP0,TP,2012
2	2203-000509	1	C-CERAMIC,CHIP	0.0022nF,0.25pF,50V,NP0,TP,1608
2	2203-000626	1	C-CERAMIC,CHIP	0.022nF,5%,50V,NP0,TP,1608
2	2203-000626	1	C-CERAMIC,CHIP	0.022nF,5%,50V,NP0,TP,1608
2	2203-000626	1	C-CERAMIC,CHIP	0.022nF,5%,50V,NP0,TP,1608
2	2203-000626	1	C-CERAMIC,CHIP	0.022nF,5%,50V,NP0,TP,1608
2	2203-000681	1	C-CERAMIC,CHIP	0.027nF,5%,50V,NP0,TP,1608
2	2203-000681	1	C-CERAMIC,CHIP	0.027nF,5%,50V,NP0,TP,1608
2	2203-000681	1	C-CERAMIC,CHIP	0.027nF,5%,50V,NP0,TP,1608
2	2203-000715	1	C-CERAMIC,CHIP	3.3nF,10%,50V,X7R,TP,1608,-
2	2203-000730	1	C-CERAMIC,CHIP	0.0039nF,0.25pF,50V,NP0,TP,1608
2	2203-000761	1	C-CERAMIC,CHIP	330nF,10%,16V,X7R,TP,2012,-
2	2203-000783	1	C-CERAMIC,CHIP	0.33nF,5%,50V,NP0,TP,1608
2	2203-000783	1	C-CERAMIC,CHIP	0.33nF,5%,50V,NP0,TP,1608
2	2203-001071	1	C-CERAMIC,CHIP	0.056nF,5%,50V,NP0,TP,1608
2	2203-001071	1	C-CERAMIC,CHIP	0.056nF,5%,50V,NP0,TP,1608
2	2203-001408	1	C-CERAMIC,CHIP	0.27nF,5%,50V,NP0,TP,1608
2	2203-001408	1	C-CERAMIC,CHIP	0.27nF,5%,50V,NP0,TP,1608
2	2203-001607	1	C-CERAMIC,CHIP	0.22nF,5%,50V,NP0,TP,1608
2	2203-001683	1	C-CERAMIC,CHIP	0.068nF,5%,50V,NP0,TP,1608
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-

Level	Part No	Quantity	Description	Specification
2	2203-005148	1	C-CERAMIC,CHIP	100nF,10%,16V,X7R,TP,1608,-

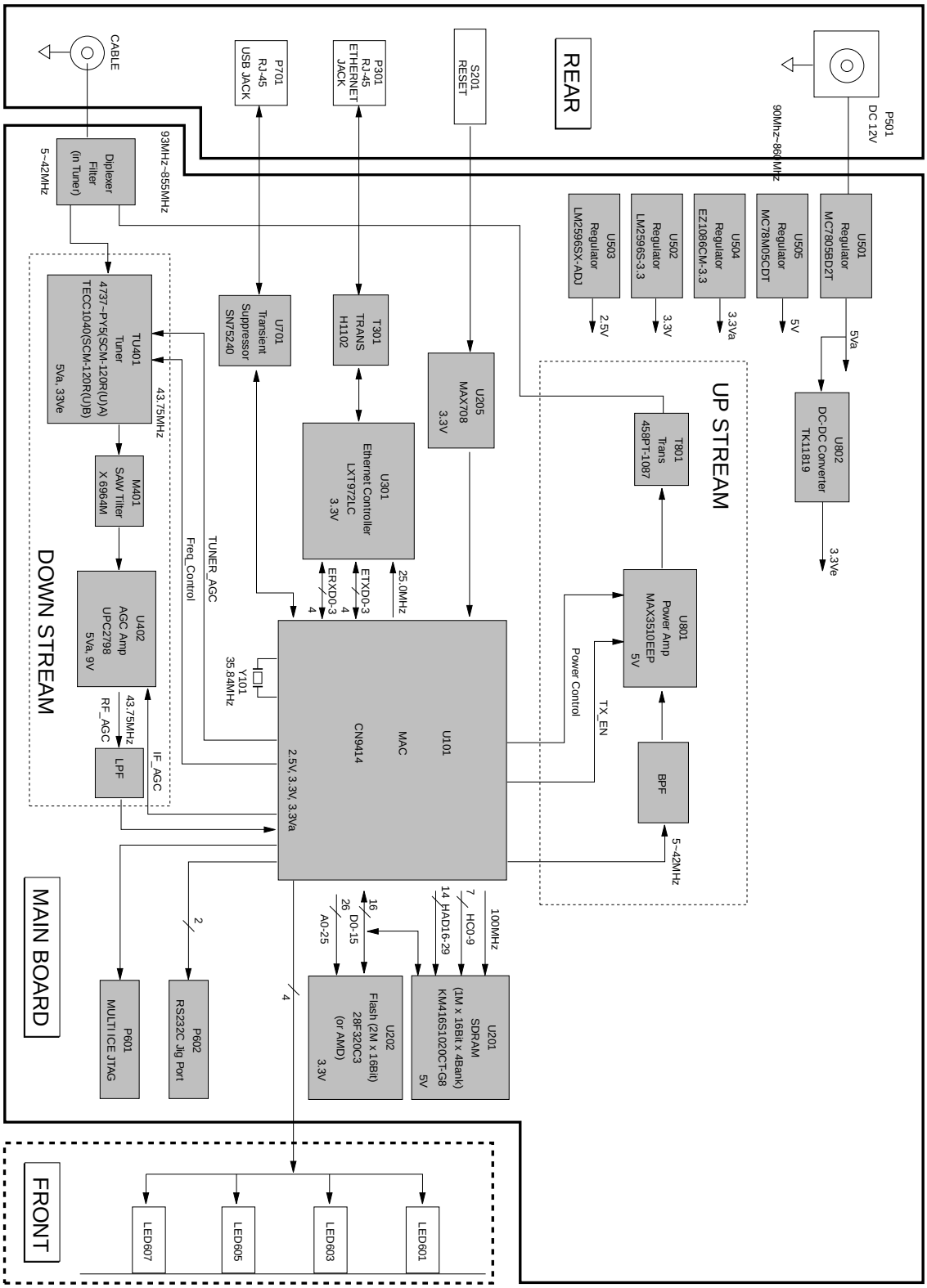
Level	Part No	Quantity	Description	Specification
2	2203-005457	1	C-CERAMIC,CHIP	1nF,10%,2KV,X7R,TP,4525,-
2	2401-002127	1	C-AL	220uF,20%,35V,LZ,TP,10x12.5mm,-
2	2401-002127	1	C-AL	220uF,20%,35V,LZ,TP,10x12.5mm,-
2	2401-003400	1	C-AL	330uF,20%,25V,LZ,TP,10x12.5,5
2	2401-003400	1	C-AL	330uF,20%,25V,LZ,TP,10x12.5,5
2	2401-003400	1	C-AL	330uF,20%,25V,LZ,TP,10x12.5,5
2	2402-000144	1	C-AL,SMD	3.3uF,20%,50V,GP,TP,4.3x4.3x5.
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-000204	1	C-AL,SMD	10uF,20%,16V,WT,TP,4.3x4.3x5.4
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2402-001042	1	C-AL,SMD	100uF,20%,16V,GP,TP,6.6x6.6x5.4mm
2	2601-001056	1	TRANS-SMD,PULSE	350uH,-,1:1,1:1,12.7x6.73x5.97mm,TP
2	2603-000051	1	TRANS-MATCHING	50ohm,1:1,-,2P:3P,6.9x6.9x4.4mm,TP
2	2703-000137	1	INDUCTOR-SMD	150nH,10%,2.92x2.79x2.29mm
2	2703-000206	1	INDUCTOR-SMD	39nH,10%,2.92x2.79x2.29mm
2	2703-000206	1	INDUCTOR-SMD	39nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000218	1	INDUCTOR-SMD	47nH,10%,2.92x2.79x2.29mm
2	2703-000246	1	INDUCTOR-SMD	820nH,10%,2.92x2.79x2.29mm
2	2703-000246	1	INDUCTOR-SMD	820nH,10%,2.92x2.79x2.29mm
2	2703-000301	1	INDUCTOR-SMD	2.7uH,10%,0.8x1.6x0.8mm
2	2703-000350	1	INDUCTOR-SMD	10uH,20%,7.3x7.3x4.75mm
2	2703-000350	1	INDUCTOR-SMD	10uH,20%,7.3x7.3x4.75mm
2	2703-000350	1	INDUCTOR-SMD	10uH,20%,7.3x7.3x4.75mm

Level	Part No	Quantity	Description	Specification
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000351	1	INDUCTOR-SMD	100uH,20%,7.3x7.3x4.75mm
2	2703-000353	1	INDUCTOR-SMD	47uH,20%,7.3x7.3x4.75mm
2	2703-000403	1	INDUCTOR-SMD	22uH,10%,3.2x2.5x2.2mm
2	2703-000403	1	INDUCTOR-SMD	22uH,10%,3.2x2.5x2.2mm
2	2703-000403	1	INDUCTOR-SMD	22uH,10%,3.2x2.5x2.2mm
2	2703-001689	1	INDUCTOR-SMD	1.2mH,20%,6.0x6.0x4.3mm
2	2703-002089	1	INDUCTOR-SMD	47uH,20%,12.0x12.0x4.3mm
2	2801-003925	1	CRYSTAL-SMD	35.84MHz,30ppm,28-AAN,20pF,80ohm,TP
2	2904-001111	1	FILTER-SAW AV	43.75MHz,SIP5P,ST,14.5dB,DIGIT
2	3301-001273	1	CORE-FERRITE BEAD	CHIP,600OHM,1608X0.8MM,200MA,TP,FERRITE,.65OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3301-001463	1	CORE-FERRITE BEAD	AB,120OHM,1.6X0.8X0.8MM,200MA,TP,FERRITE,0.5OHM
2	3404-001075	1	SWITCH-TACT	12V,50mA,160gf,6x6x5.85mm,SPST
2	3711-000956	1	CONNECTOR-HEADER	BOX,4P,1R,2.5MM,ANGLE,SN
2	3711-001361	1	CONNECTOR-HEADER	NOWALL,20P,2R,2.54mm,STRAIGHT,
2	3722-000117	1	JACK-DC POWER	3P,3.5mm,AG,BLK,NO
2	3722-001101	1	JACK-USB	4P/2C,8.38mm,AU,IVR,#22-28
2	3722-001399	1	JACK-MODULAR	8P/8C,STANDARD,Y,ANGLE,STANDARD,N,BLK,AUF
2	4715-000127	1	SURGE ABSORBER	300V,15%,500A,-,-
2	4715-000127	1	SURGE ABSORBER	300V,15%,500A,-,-
2	GL39-00031A	1	CBF LINE CORD	PCD2000-AU04,SCM-120U, 4P/4C,1800mm,WHT,USB,UL2725
2	GL39-40002A	1	CBF HARNESS	SCM-100R,ROUND,UL E105829,1,83
2	GL40-00011A	1	TUNER	4737PY5-3X8743,SCM-120R,-,-,-,-,75OHM,-,F-CONN, -,-,BK,-,V159,U466MHZ,43DB(VOLTA)
2	GL41-00015A	1	PCB-MAIN	SCM-120R,FR-4,4L,-,1.6T,150x130 mm,-,1,PCB,-
2	GL44-00012A	1	ADAPTOR-SCM-120R	SCM-120R,14.4W,120VAC,12VDC,1.2A,-,-,60Hz, -,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-,-
2	GL68-00062A	1	MANUAL-USERS (SCM-120U)	SCM-120U,SEC,ENG,USA,MOJO,-,W130,L175,VER.0A,-,-,-

Appendix D
Servicing Diagrams

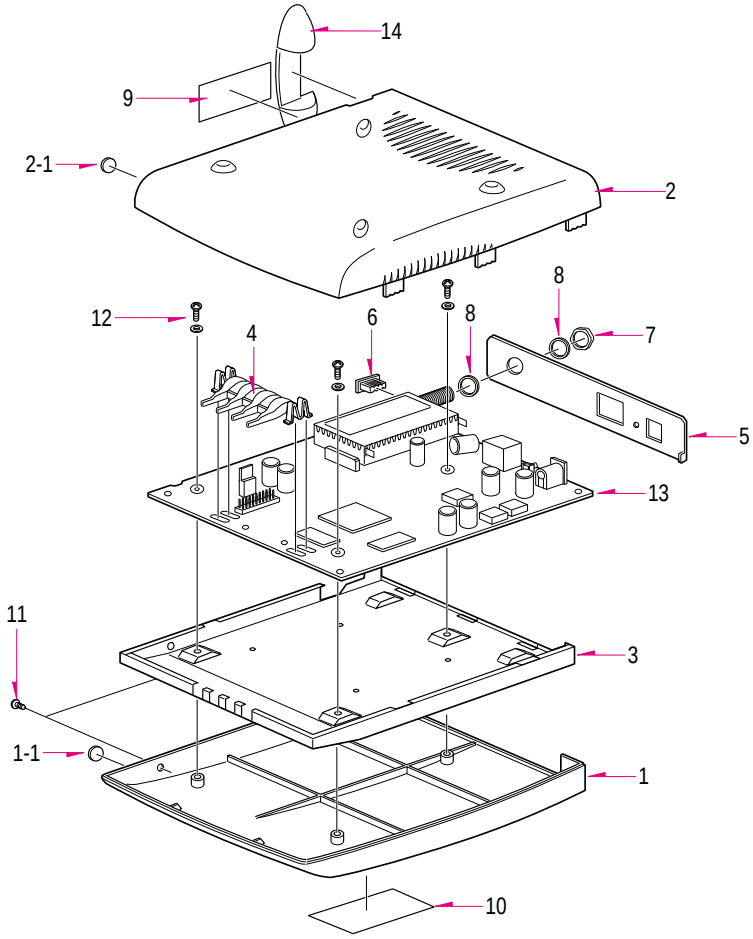
Appendix D Servicing Diagrams

Block Diagram



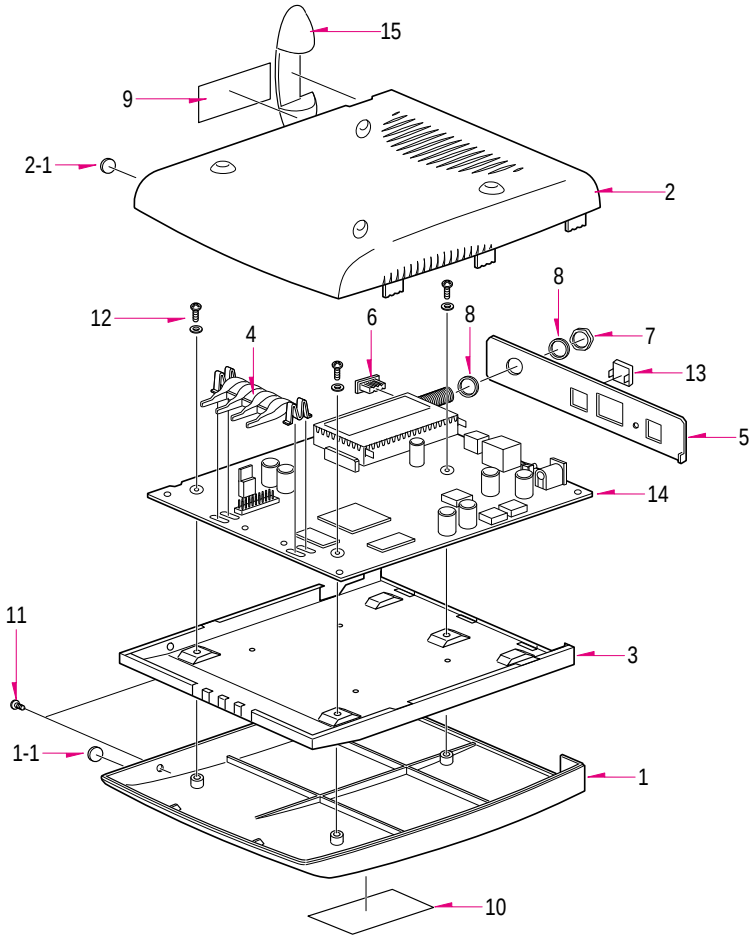
Exploded View

InfoRanger SCM-120R



NO	DESCRIPTION	MATERIAL	Q'TY	REMARKS
14	STAND	Polycavonate ABS (UL94V-0)	1	GL72-00024A
13	ASS'Y-MAIN BOARD (SCM-120R)	PBA	1	
12	SCREW. M3,PH, + ,L6	SM2OC	3	6001-000562
11	SCREW. M3,FH, + ,L6	SM2OC	2	6001-000559
10	LABEL BAR-CODE	TETRON	1	GL68-00070A
9	LABEL RATING (SCM-120R)	TETRON	1	GL68-00065A
8	WASHER -PLAIN	SOP 1	2	6031-001163
7	NUT-HEX.	SM2OC	1	6021-001029
6	CONNECTOR CAP	SILICON	1	GL73-00005A
5	REAR PAWEL (SCM-120R)	AL t1.6	1	GL71-00006A
4	LED INDICATOR	PC	1	GL72-00027A
3	RIGHT SHIELD COVER	SECC t0.3	1	GL70-00020A
2-1	RUBBER FOOT	N.RUBBER	1	GL73-00006A
2	LEFT COVER	Polycavonate ABS (UL94V-0)	1	GL72-00026A
1-1	RUBBER FOOT	N.RUBBER	1	GL73-00006A
1	RIGHT COVER	HPIS (UL94V-0)	1	GL72-00025A

InfoRanger SCM-120U



NO	DESCRIPTION	MATERIAL	Q'TY	REMARKS
15	STAND	Polycavonate ABS (UL94V-0)	1	GL72-00024A
14	ASS'Y-MAIN BOARD (SCM-120U)	PBA	1	
13	CONNECTOR (USB) BUSHING	HPIS (UL94V-0)	1	GL72-00030A
12	SCREW. M3,PH, + ,L6	SM2OC	3	6001-000562
11	SCREW. M3,FH, + ,L6	SM2OC	2	6001-000559
10	LABEL BAR-CODE	TETRON	1	GL68-00070A
9	LABEL RATING (SCM-120U)	TETRON	1	GL68-00066A
8	WASHER -PLAIN	SOP 1	2	6031-001163
7	NUT-HEX.	SM2OC	1	6021-001029
6	CONNECTOR CAP	SILICON	1	GL73-00005A
5	REAR PAWEL (SCM-120U)	AL t1.6	1	GL71-00010A
4	LED INDICATOR	PC	1	GL72-00027A
3	RIGHT SHIELD COVER	SECC t0.3	1	GL70-00020A
2-1	RUBBER FOOT	N.RUBBER	1	GL73-00006A
2	LEFT COVER	Polycavonate ABS (UL94V-0)	1	GL72-00026A
1-1	RUBBER FOOT	N.RUBBER	1	GL73-00006A
1	RIGHT COVER	HPIS (UL94V-0)	1	GL72-00025A

Technical Support

SAMSUNG offers the highest level of customer service in the industry. Friendly and knowledgeable customer service is available as follows through our web site or your service provider.

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- Support when problems arise
- FAQs

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